2007 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 8

Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program

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EXECUTIVE SUMMARY

The Nebraska Game and Parks Commission (NGPC) in cooperation with the U.S. Army Corps of Engineers (USACE) began sampling Segment 8 in 2005. Segment 8 begins at Lower Ponca Bend (River mile [R.M.] 753.0), where river channelization begins, and continues down to the mouth of the Platte River (R.M. 595.0). Sampling began on October 28, 2006 with the sturgeon season, after water temperatures dropped below 12.7°C, and continued until November 20, when ice inhibited boat navigation. Sampling resumed on March 6, 2007 after ice flows subsided and continued until June 30. During the sturgeon season, a total of 619 samples were completed using gill nets, otter trawls, and trammel nets. The fish community season began on July 1 and continued throughout the summer and early fall until mid-October when the water temperatures dropped below 12.7°C. During the fish community season, 574 samples were completed using otter trawls, trammel nets, and mini-fyke nets.

A total of 34 pallid sturgeon *Scaphirhynchus albus* were captured during the 2007 sampling season. Hatchery reared pallid sturgeon recaptures accounted for 30 fish, while the remaining 4 were determined as wild origin via genetic verification. From 2005 to 2007, 6 of 61 hatchery reared pallid sturgeon sampled were thought to have shed their PIT tags (Hamel and Steffensen 2007; Barada and Steffensen 2006). This results in a 90% pit tag retention rate in Segment 8. Six year classes of hatchery reared pallid sturgeon (2001-2006) that have been stocked into RPMA #4 were recaptured during 2007. Relative condition (Kn) of hatchery reared pallid sturgeon recaptured in 2007 ranged from 0.85 to 1.18. Stocked pallid sturgeon grew on an average of 0.16 mm/day.

Pallid sturgeon were sampled throughout the entire length of Segment 8 from Lower Ponca bend (R.M. 753.0) downstream to Papillion bend (R.M. 596.0). The greatest number of pallid sturgeon captures was from Upper Sioux City bend (R.M. 734.7). During the fish community season, six pallid sturgeon were sampled from this bend at the confluence of the Big Sioux River, which is the most pallid sturgeon that have been sampled from one area in Segment 8. One additional pallid sturgeon was sampled on this bend during the sturgeon season.

Only one pallid sturgeon was collected with a non-standard gear (2.5” monofilament gill net) in 2007. All other pallid sturgeon were captured with standardized gears. Trammel

nets were the most effective gear for collecting pallid sturgeon (N=17), followed by otter trawls (N=11), and gill nets (N=5). As seen in previous years, mini-fyke nets were the only standard gear that did not collect any pallid sturgeon. No young-of-the-year pallid sturgeon have been collected with any gear in Segment 8 since sampling began in 2005. Although statistical comparisons were not made for catch rates between years, CPUE of pallid sturgeon in trammel nets has increased during both seasons since 2005 (Hamel and Steffensen 2007). Otter trawl catch rates have decreased during the sturgeon season since 2005; however, CPUE nearly doubled during the fish community season in 2007 (Hamel and Steffensen 2007). Gill nets have been the most effective gear for capturing pallid sturgeon in many segments of the middle and lower Missouri River (Caton et al. 2007; Hamel and Steffensen 2007; Plauck et al. 2007; Shuman et al. 2007; Steffensen and Hamel 2007; Utrup et al. 2007). However, during the 2007 sampling season in Segment 8, trammel nets and otter trawls caught two and three times as many pallid sturgeon as gill nets, respectively. Although trammel nets and otter trawls caught more pallid sturgeon, gill nets had the highest CPUE values for wild pallid sturgeon. The sturgeon season continues to be the best season to capture wild pallid sturgeon; only one wild pallid sturgeon has been collected during the fish community season since sampling began in Segment 8.

Pallid sturgeon were captured within a variety of macro and mesohabitat types; however, the channel border within the inside bend accounted for the most captures (56%). Further analysis indicated that pallid sturgeon were captured in different habitat types (i.e., depth, temperature, velocity, and turbidity) relative to where targeted sampling occurred. However, these differences have not been consistent from year to year, implying that pallid sturgeon capture locations may not be a function of habitat selection (Hamel and Steffensen 2007). Very few macrohabitat types are available on the channelized Missouri River. Historically, most pallid sturgeon captures have come from the pool or channel border mesohabitat within the inside bend; however, this is where approximately 75% of all sampling occurs. Sampling in the confluence of the Big Sioux River in Upper Sioux City bend (R.M. 734.7) resulted in the capture of seven hatchery reared pallid sturgeon. Although these captures comprised 86% of all pallid sturgeon catches with otter trawls during the fish community season, only 4% of sampling effort was directed at this habitat type.

Missouri River Fish Community

A total of 2,807 shovelnose sturgeon *S. platorynchus* were captured in gill nets (N=1,367), trammel nets (N=1,153), otter trawls (N=153), 2.5" monofilament gill nets (Non-standard gear; N=133), and push trawls (Non-standard gear; N=1). For all gears combined, the ratio of pallid sturgeon to shovelnose sturgeon sampled in 2007 was 1:83. Very few sub-stock (0-149 mm and 150-249 mm) and stock size (250-379 mm) shovelnose sturgeon have been collected in Segment 8, implying that shovelnose sturgeon recruitment may be low or infrequent. Length frequency distributions of shovelnose sturgeon from 2005-2007 indicate that comparable numbers of adult size (i.e., 450-650 mm) fish were found each year (Hamel and Steffensen 2007; Barada and Steffensen 2006). Similar trends in length frequency distributions of shovelnose sturgeon have been observed in other segments of the Missouri River, indicating that recruitment of shovelnose sturgeon is probably occurring on an annual basis, although year class strength is unknown (Caton et al. 2007; Plauck et al. 2007; Steffensen and Hamel 2007; Utrup et al. 2007; Steffensen and Barada 2006).

Otter trawls were most productive in collecting *Macrhybopsis* spp. All sturgeon chub *M. gelida* (N=3), sicklefin chub *M. meeki* (N=1), and 78 of 80 speckled chub *M. aestivalis* (N=93) were collected by otter trawls throughout both seasons. There was only one *Hybognathus* species (Brassy minnow *H. hankinsoni*) captured in Segment 8 during 2007. Although it is difficult to make accurate comparisons between years due to low sample sizes, it appears that both *Macrhybopsis* and *Hybognathus* spp. are declining through time.

Mini-fyke nets were the most effective method to sample sand shiners *Notropis stramineus*, collecting 93% of the 435 individuals. A total of 1,235 blue suckers *Cycleptus elongatus* were captured in 2007, with trammel nets and gill nets comprising 54% and 36% of the catch, respectively. Finally, there were 93 saugers *Sander canadensis* captured in 2007, with gill nets and trammel nets catching the most fish (N=51 and 31, respectively). A grand total of 21,512 fish representing 53 species were captured during 2007 in Segment 8.

Hamel, M.J., and K.D. Steffensen. 2008. 2007 Annual Report, Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River: Segment 8. Nebraska Game and Parks Commission, Lincoln, Nebraska.

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Introduction

Pallid sturgeon *Scaphirynchus albus* are native to the Missouri and Mississippi River systems and has evolved and adapted to large river conditions. Due to population declines, pallid sturgeon were federally listed as endangered in 1990. Modification of the pallid sturgeon's habitat by human activities has blocked fish movement, destroyed or altered spawning areas, reduced food sources or ability to obtain food, altered water temperature, reduced turbidity, and changed the hydrograph (USFWS 1993). In response to obvious declines in population and lack of recruitment, the United States Fish and Wildlife Service developed the Biological Opinion on the Operation of the Missouri River Main System Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (Bi-Op) in 2000. This report made recommendations to the U.S. Army Corp of Engineers (USACE) to modify flows of the Missouri River to a more natural regime, to increase pallid sturgeon propagation and augmentation efforts, and to assist and provide funding for a basin-wide pallid sturgeon assessment. In response to the Bi-Op, the USACE formed the Pallid Sturgeon Population Assessment Team with representatives from federal and state agencies and universities. The team developed standard operating procedures (SOP) for long-term pallid sturgeon and associated fish community assessment for the Missouri River. This included creating standard habitat definitions, selecting and describing standard sampling gears thought to be suitable for use in the Missouri River, creating sampling protocols for sampling fish and habitat parameters and developing standard data sheets and reporting procedures.

The 2006 sampling season extended from the fall of 2005 though the fall of 2006 and was divided into two seasons: the sturgeon season and the fish community season. The reason for a split in seasons was that during the sturgeon season, the capture of sturgeon was more efficient due to increased sturgeon movement and the ability to use gill nets, an effective gear for sampling sturgeon when water temperatures permit. The sturgeon season was defined as the period when water temperatures fall below 12.7^{o} C (55^{o} F) in the fall, until 30 June. While water temperatures were below 12.7^{o} C, experimental gill nets were used, and above this temperature, two additional gears were used: 1.0" trammel nets and otter trawls. Sampling was conducted on the bend level with all bends being randomly selected.

The fish community season began July 1 and continued until water temperatures dropped below 12.7^{o} C. Three gear types were used during the fish community season: 1.0" trammel nets, otter trawls, and mini-fyke nets. Sampling was conducted on the bend level with all bends being randomly selected. The fish community season is the best time to identify natural reproduction of pallid sturgeon and other native target species. Because sturgeon are less active and gill nets can not be used because of temperature restrictions, efforts focus on sampling the associated fish community, including chubs and minnows, which are more readily sampled during this time. The Pallid Sturgeon Population Assessment Team selected 8 target species that represent the native warm water benthic fish community (Appendix A). The eight target species are: shovelnose sturgeon *S. platorynchus*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, sand shiner *Notropis stramineus, Hybognathus* species (western silvery minnow *H. argyritis*, brassy minnow *H. hankinsoni*, and plains minnow *H. placitus*), blue sucker *Cycleptus elongatus*, and sauger *Sander canadense*. During the fish community season, these native species along with pallid sturgeon are targeted.

The objectives and measurable hypotheses for the Pallid Sturgeon Population Assessment Team are as follows:

Objective 1. Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.

1.1. H_o: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.
H_a: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.

1.2 H_o: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages remain constant overt time
H_a: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages increase or decrease over time.

1.3 H_o: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.
H_a: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.

1.4 H_o: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages remains constant over time.
H_a: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages increases or decreases over time.

Objective 2. Document annual results and long-term trends of habitat usage of wild pallid sturgeon and hatchery stocked pallid sturgeon by season by life stage.

2.1 H_o: Stocked and wild pallid sturgeon use the same habitat during all life stages annually.
H_a: Stocked and wild pallid sturgeon do not use the same habitat during all life stages annually.

2.2 H_o: Stocked and wild pallid sturgeon use the same habitat during all life stages over the long term.
H_a: Stocked and wild pallid sturgeon do not use the same habitat during all life stages over the long term.

Objective 3. Document the population structure and dynamics of pallid sturgeon in the Missouri River system.

3.1 H_o: The population structure of stocked and wild pallid sturgeon remains constant over time.
H_a: The population structure of stocked and wild pallid sturgeon changes over time.

3.2 H_o: The population dynamics of stocked and wild pallid sturgeon remain constant over time.
H_a: The population dynamics of stocked and wild pallid sturgeon change over time.

Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River System.

4.1 H_o: Annual trends in native target species abundance are stable throughout the year.
H_a: Annual trends in native target species abundance increase or decrease throughout the year.

4.2 H_o: Annual trends in native target species geographic distribution remains stable throughout the year.
H_a: Annual trends in native target species geographic distribution increases or decreases throughout the year.

4.3 H_o: Long-term trends in native target species population abundance are stable over time.
H_a: Long-term trends in native target species population abundance increases or decreases over time.

4.4 H_o: Long-term trends in the native target species geographic distribution remain constant over time.
H_a: Long-term trends in the native target species geographic distribution increases or decreases over time.

Objective 5. Document annual results and long-term trends of habitat usage of the native target species by season and life stage.

5.1 H_o: Native target species use the same habitat during all life stages annually.
H_a: Native target species do not use the same habitat during all life stages annually.

5.2 H_o: Native target species use the same habitat during all life stages over the long term.
H_a: Native target species do not use the same habitat during all life stages over the long term.

Objective 6. Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.

6.1 H_o: Annual trends in non-target species abundance are stable throughout the year.
H_a: Annual trends in non-target species abundance are increasing or decreasing throughout the year.

6.2 H_o: Annual trends in non-target species geographic distribution remains stable throughout the year.
H_a: Annual trends in non-target species geographic distribution increases or decreases throughout the year.

6.3 H_o: Long-term trends in non-target species population abundance are stable over time.
H_a: Long-term trends in non-target species population abundance increases or decreases over time.

6.4 H_o: Long-term trends in the non-target species geographic distribution remain constant over time.
H_a: Long term trends in the non-target species geographic distribution increases or decreases over time.

Study Area

The project area includes the Missouri River from Fort Peck Dam (River Mile [R.M.] 1771.5) to the confluence of the Missouri and Mississippi Rivers (R.M. 0.0) and the lower reach of the Kansas River from the Johnson County Weir (R.M. 15.4) to the confluence with the Missouri River (R.M. 0.0). The Biological Opinion divided the Missouri River into river and reservoir reaches and categorized each reach as a high, moderate or low priority management area. The areas which were given high priority designation in the Bi-Op for the pallid sturgeon include Segment Area 2 (Fort Peck Dam, Montana to the headwaters of Lake Sakakawea, North Dakota), Area 8 (Fort Randall Dam, South Dakota to the Mouth of the Niobrara River, Nebraska), and Areas 10 through 15 (Gavins Point Dam, Nebraska/South Dakota to the mouth of the Missouri River at St. Louis, MO).

The Pallid Sturgeon Population Assessment Team identified 14 river segments within these reaches based on changes in physical attributes such as degrading or aggrading stream bed, flow fluctuation, natural hydrograph, stream gradient, geology, water temperature, turbidity, substrate, discrete habitat changes (tributary or tributary influence) and modifications (presence of restoration projects) (Drobish, editor 2008). There are also several areas being sampled that were not designated as high priority areas in the Bi-Op. These are being sampled because of known pallid sturgeon use and include the Kansas River from Johnson County Weir to the mouth and Bi-Op Segment Area 9 (Niobrara River, Nebraska to the headwaters of Lewis and Clark Lake Nebraska/South Dakota).

Methods

Sampling was conducted in accordance with the current Standard Operating Procedures (Drobish, editor 2008) established by a panel of representatives from various State and Federal agencies involved with pallid sturgeon recovery on the Missouri River. Descriptions of these procedures are reported in the appropriate sections.

Sampling Site Selection and Habitat Description

Nebraska Game and Parks Commission was contracted to monitor Segment 8 from Lower Ponca Bend (R.M. 753.0) downstream to the mouth of the Platte River (R.M. 595.0).

Eighteen bends within this segment were randomly selected to be sampled for the sturgeon season and the fish community season.

The Pallid Sturgeon Assessment Team developed a standard set of habitat classifications for the Missouri River (Appendix B) to describe areas of sampling effort. These classifications are broken down into three distinct levels. Each river bend contains three continuous macrohabitats: main channel outside bend (OSB), main channel inside bend (ISB) and main channel cross-over (CHXO). Additional discrete macrohabitats have been identified that may not be present in every bend. These include: large tributary mouth (TRML), small tributary mouth (TRMS), tributary confluence (CONF), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), tributary (TRIB) and non-connected secondary channel (SCN). Mesohabitats have been established and defined to further classify areas within macrohabitats. Mesohabitat classifications include bars (BARS), pools (POOL), channel borders (CHNB), thalweg (TLWG) and island tips (ITIP). Bars are sandbars or shallow bankline habitat at the area of terrestrial/aquatic interface, where water depth is less than 1.2 m deep. Pools are areas immediately downstream from sandbars, dikes, snag-piles or other obstructions that have formed a scour hole greater than 1.2 m deep. Channel borders lie along a bankline or sandbar area between the thalweg and the 1.2 m depth interval. Thalweg is the main channel between the channel borders and is the area of maximum depth. Island tips are the areas immediately downstream of a bar or island where two channels converge and water depth is greater than 1.2 m.

Sampling Gear

Sampling gear and methods were developed by the Pallid Sturgeon Assessment Team and described in Long-term Pallid Sturgeon and Associated Fish Community Assessment for the Missouri River and Standardized Guidelines for Sampling and Data Collection, (Drobish 2008). Gear types and methods used are as follows.

Gill Net

The standard gill net was a four panel experimental gill net 30.5 m (100 ft) long with a height of 2.4 m (8 ft). The standard gill net had four 7.6 m (25 ft) panels consisting of 38.1 mm (1.5") (Panel 1), 50.8 mm (2.0") (Panel 2), 76.2 mm (3.0") (Panel 3), and 101.6 mm (4.0") (Panel 4) multifilament bar mesh. Twine size was #104 for the 38.1 mm and 50.8 mm

panels and #139 for the 76.2 mm and 101.6 mm panels. The float line was a braided poly-foam core of 13 mm (1/2") diameter and the lead line was 7.1 mm (9/32") (22.7 kg / 183 m). A double length gill net (61 m or 200 ft) could be used when needed to sample a particular location and consisted of two standard gill nets attached together but counted as twice the effort. Panel numbering continued for 61 m nets, so the second 38.1 mm mesh was panel 5, the second 50.8 mm mesh was panel 6, the second 76.3 mm mesh was panel 7 and the second 101.6 mm mesh was panel 8. The first panel set (38.1 mm (panel 1) or 101.6 mm mesh (panel 4 or 8)) was selected randomly and recorded. Gill net samples were overnight sets with a maximum set time of 24 hours.

Otter Trawl

The standard otter trawl had a width of 4.9 m (16 ft), height of 0.9 m (3 ft) and length of 7.6 m (25 ft). The trawl had a 6.35 mm (1/4") inner bar mesh and a 19 mm (0.75", # 9 sapphire twine outer bar mesh), with a cod-end opening of 406.4 mm (16"). Trawl doors are made from 19.1 mm (3/4") marine plywood, measuring 762 mm (30") by 381 mm (15"), and were used to keep the trawl deployed on the river bottom. Otter trawls were fished downstream with the distance of the trawl dependent upon the size of the macrohabitat and mesohabitat being sampled. Otter trawl samples covered a minimum of 75 m (246 ft) and a maximum of 300 m (984 ft).

1" Trammel Net

The standard 1.0" trammel net had a length of 38.1 m (125 ft), with an inner mesh 2.4 m (8 ft) deep and two outer walls 1.8 m (6 ft) deep. The inner mesh was composed of # 139 multifilament twine with a bar mesh size of 25.4 mm (1.0"). The outer walls were # 9 multifilament twine with a bar mesh size of 203.2 mm (8.0"). The float line was a 12.7 mm (1/2") foam core and the lead line was 22.7 kg (50 lb). Trammel nets were drifted a minimum of 75 m and a maximum of 300 m.

Mini-Fyke Net

The standard mini-fyke net had two rectangular frames (1.2 m (4.0 ft) by 0.6 m (2.0 ft)) and two hoops (0.6 m (2.0 ft)) made of oil tempered spring steel. A 4.5 m (15 ft) by 0.6 m (2.0 ft) lead was connected to the second rectangular frame. The mini-fyke net had 3 mm (1/8") ace mesh with a 29.5 kg (65lb) lead core line. Mini-fyke net samples were overnight sets with a maximum set time of 24 hours.

Push Trawl

The non-standard or wild push trawl was an envelope shaped net that was pushed along the bottom straining fish from shallow water habitats. The net was fished from the front of a powered boat while being pushed downstream. The push trawl had a width of 2.4 m (8 ft), height of 0.61 m (24 in) and length of 1.8 m (6 ft). The trawl was composed entirely of a 0.4 m (3/16") bar mesh. Trawl doors were used to keep the trawl deployed on the river bottom and were made from 19.1 mm (3/4") marine plywood, measuring 762 mm (30") by 381 mm (15"). These nets were used during the 2006 fish community season in an attempt to collect additional information about young-of-the-year *Scaphirhynchus* species.

2.5" Monofilament Gill Net

The non-standard or wild 2.5" monofilament gill net was 61 m (200 ft.) long with a height of 2.4 m (8 ft.) and was constructed of 2.5" #208 monofilament nylon netting. The float line was a braided poly-foam core of 13 mm (1/2") diameter and the lead line was 7.1 mm (9/32") (22.7 kg/183 m). Gill net samples were overnight sets with a maximum set time of 20 hours. This net was used during the 2007 sampling season in an attempt to collect pallid sturgeon broodstock.

Data Collection and Analysis

Fish Data Collection

When a pallid sturgeon was sampled, the fish was measured to the nearest millimeter and weighed to the nearest gram, morphometric measurements were recorded along with pictures, habitat parameters, and all tagging information. If the pallid sturgeon had not been previously PIT tagged, a PIT tag was placed in accordance with the protocols. Other target species were measured to the nearest millimeter and weighed to the nearest gram. All non-target species collected were measured to nearest millimeter and released. Mini-fyke net samples were preserved in 10% formalin and brought back to the lab for identification when samples were excessively large. Mini-fyke net samples were identified to species and stored in 70% alcohol.

Associated Environmental Data

Habitat samples were collected at every pallid sturgeon capture site and were randomly collected at 25% of the remaining sampling sites by macrohabitat and mesohabitat.

The predetermined parameters for habitat sampling were GPS coordinates (latitude and longitude in decimal degrees), water depth (m), water velocity ((mps) at bottom, 0.2, and 0.8 of water column), water temperature (^{o}C), turbidity (NTU) and a sediment profile (based on percent of gravel, sand and silt).

Genetic Validation

Collection methods, including the handling of pallid sturgeon, conformed with methods described in Biological Procedures and Protocol for Collecting, Tagging, Sampling, Holding, Culture, Transporting, and Data Recording for Researchers and Managers Handling Pallid Sturgeon (U.S. Fish and Wildlife Service 2008). Fin clips for DNA analysis were taken from pallid sturgeon and suspected hybrids and sent to Abernathy Fish Technology Center for validation.

Analyses

All datasheets were checked and submitted to the Missouri Department of Conservation. All data was processed and analyzed using Microsoft Access and SAS statistical software (SAS Institute, Version 9.1) and figures were generated via SigmaPlot.

Catch per Unit Effort

All fish collections were reported as catch per unit effort (CPUE) with the associated standard error. Catch per unit effort for gill nets is reported as the number of fish per 100 feet of gill net per net-night. Catch per unit effort for otter trawls is reported as number of fish per 100 linear meters trawled. Catch per unit effort for trammel nets is reported as number of fish per 100 meters drifted. Catch per unit effort for mini-fyke nets are reported as number of fish per net-night. Catch per unit effort is calculated for each subsample instead of overall catch per overall effort in order to get a measure of variance. These individual CPUEs are then averaged to get a total CPUE for an individual gear, bend or segment.

Mean annual CPUE data were checked for normality (PROC UNIVARIATE) using SAS. These data did not follow a normal distribution and were then log10 transformed. Normality assumptions were still not met. Therefore, to compare mean annual CPUE between years, non-parametric statistical analysis were conducted. PROC GENMOD used a TYPE-3 POISSON distribution to test for an overall difference amongst years. For the

model, PROC GENMOD reports the source data (i.e., year), the degrees of freedom associated with the source, an F value statistic with associated p-value and a chi-squared statistic with associated p-value for testing the significance of the source to the model. When overall CPUE data were significantly different, the PROC GENMOD ESTIMATE statement compared individual years. This determined which years were statistically different by comparing one year's data versus a different year's data. For the model, PROC GENMOD reports a label for upper and lower confidence limits and a chi-squared statistic with associated p-value for testing the significance of the model.

To determine if fish were being caught in proportion to the amount of effort being expended in each habitat type, a chi-squared analysis was performed using SAS (SAS Institute, Version 9.1). Significance was determined at $\alpha = 0.05$ for all tests.

Character Index

Pallid sturgeon, shovelnose sturgeon and hybrids can be distinguished using meristic and morphometric characteristics (Sheehan, 1999). Sheehan et al. (1999) developed the character index (CI) using two meristics (dorsal and anal fin ray counts) and five morphometric ratios. This equation categorized *Scaphirhynchus* specimens into three categories. Character index values for pallid sturgeon range from -1.48 to -0.09, hybrid sturgeon from -0.45 to 0.51 and shovelnose sturgeon from 0.37 to 1.33.

Relative Condition

The relative condition of recaptured hatchery reared pallid sturgeon was calculated using the formula:

$$Kn = (W / W'),$$

where W is weight of the individual and W' is the length-specific mean weight predicted by the weight-length equation calculated for that population. Keenlyne and Evanson (1993) provided a weight-length regression ($r^2 = 0.9740$) for pallid sturgeon throughout its range:

$$\log_{10}W = -6.378 + 3.357 \log_{10}L,$$

which was used to calculate a relative condition factor.

Relative Weight

The relative weight of shovelnose sturgeon was calculated using the formula:

$$Wr = 100 * (W / Ws),$$

where W is weight of the individual and Ws is the length-specific standard weight value for the species. Quist et al. (1998) provided a weight-length regression for shovelnose sturgeon throughout its range to calculate relative weight and was reported as:

$$\log_{10}W = -6.287 + 3.330 \log_{10}FL.$$

Relative Stock Densities

Length frequency indices can be used to indicate changes in a population structure. Length categories were based on the percentage of the largest known pallid sturgeon are as followed (Gablehouse 1984): sub-stock fork length < 330 mm (20%), stock fork length = 330 – 629 mm (20 – 36%), quality fork length = 630 – 839 mm (36 - 45%), preferred fork length = 840 – 1039 mm (45 – 59%), memorable fork length = 1040 – 1269 mm (59 – 74%) and trophy fork length > 1270 mm (> 74%). Length categories based on the percentage of the largest known shovelnose sturgeon are as follows: sub-stock fork length < 250 mm (20%), stock fork length = 250 – 379 mm (20 – 36%), quality fork length = 380 – 509 mm (36 - 45%), preferred fork length = 510 – 639 mm (45 – 59%), memorable fork length = 640 – 809 mm (59 – 74%) and trophy fork length > 810 mm (> 74%). Proportional Stock Density (PSD) is proportion of fish of quality size in a stock. Relative Stock Density (RSD) is the proportion of fish of a size group in a stock. Length frequency distributions for each species for each season were compared with a Kolmogorov-Smirnov test (SAS Institute, Version 9.1).

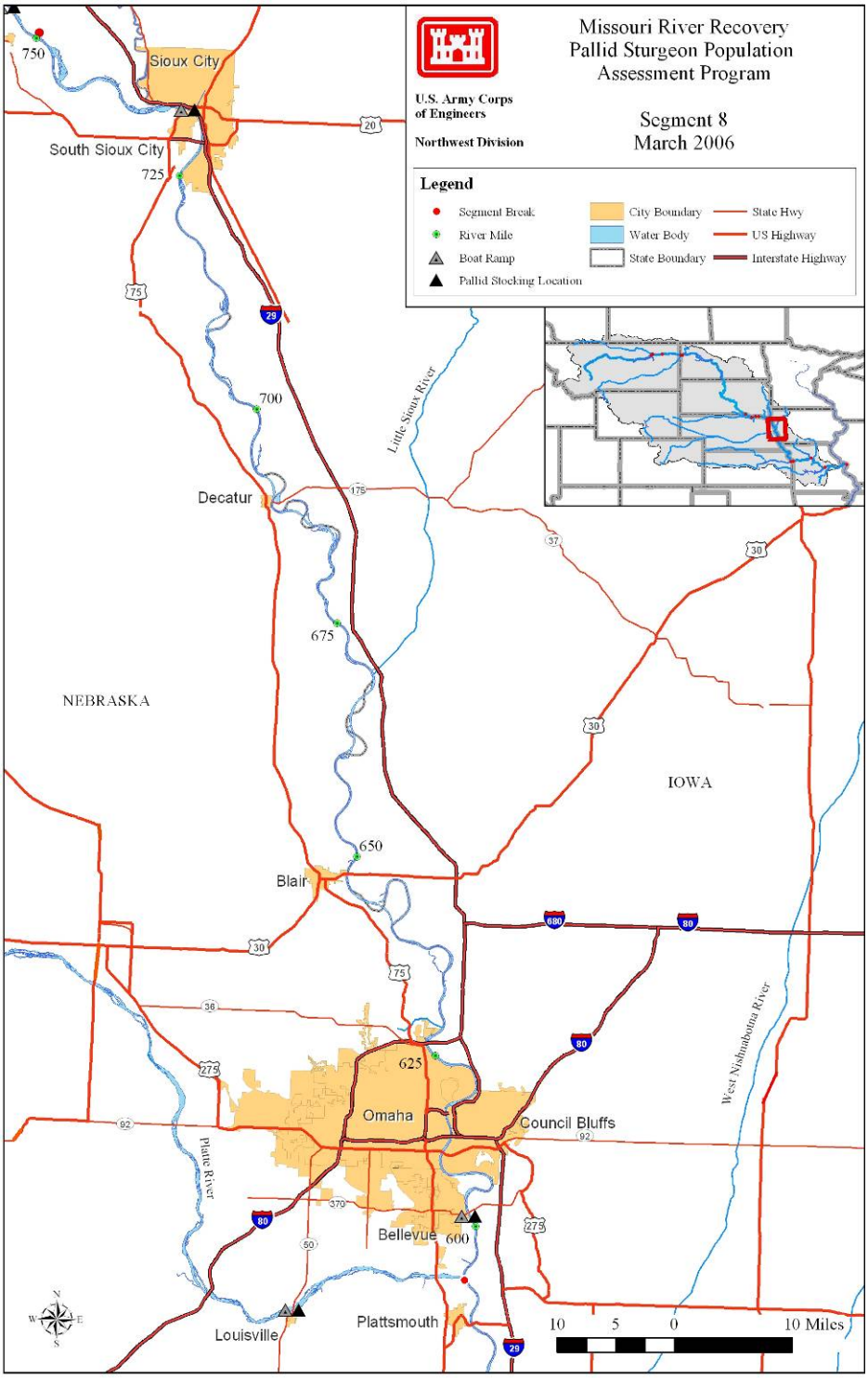

Figure 1a. Map of Segment 8 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 8 encompasses the Missouri River from Lower Ponca Bend (River Mile 735.0) to Platte River (River Mile 595.0).

Results

Effort

Sampling effort in Segment 8 is limited to a few macro and mesohabitats due to the simplification of the river by channelization. Sampling was conducted primarily in bar, pool, and channel border mesohabitats within channel cross-over and inside bend macrohabitats. The 100' and 200' standard gill nets were only used to sample fish during the sturgeon season due to temperature restrictions (Appendix C). Gill nets were set on the channel border and pool mesohabitats within the inside bend and channel cross-over macrohabitats. A total of 187 deployments resulted in 296 net nights of effort in the inside bend and 78 net nights of effort in channel cross-overs in Segment 8 during 2007 (Tables 1 and 2).

The standard 16' otter trawl was used during both the sturgeon and the fish community seasons. Otter trawls were used to sample the channel border mesohabitat within the inside bend, channel cross-over, and secondary channel connected (large) macrohabitats. Otter trawls were deployed 296 times in Segment 8 during 2007. Effort for the sturgeon season was the equivalent of 143 trawl deployments compared to 153 deployments for the fish community season.

The 1.0" trammel nets were used during both the sturgeon and fish community seasons. They were used to sample the channel border mesohabitat within the inside bend and channel cross-over macrohabitats. A total of 590 trammel net drifts were conducted in Segment 8 during 2006. Effort for the sturgeon season was the equivalent of 289 trammel net deployments compared to 301 for the fish community season.

Mini-fyke nets were used only during the fish community season. This gear is specific to sampling bar mesohabitats within the inside bend and channel cross-over macrohabitats. A total of 120 deployments resulted in 30 net nights of effort in channel cross-over macrohabitats and 90 net nights of effort in the inside bend macrohabitat.

Table 1. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by macrohabitat (total number of deployments) for Segment 8 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1 Inch Trammel Net	15	19.27	N-E	63	4	N-E	N-E	221	N-E	1	N-E	N-E	N-E	0	0	N-E
Gill Net	19	9.84		39	0			148		0				0	0	
Otter Trawl	15	9.53		32	2			107		0				2	0	
Summer – Fish Community Season																
1 Inch Trammel Net	15	20.07	N-E	61	2	N-E	N-E	234	N-E	0	N-E	N-E	N-E	2	2	N-E
Mini-Fyke Net	15	8.00		30	0			86		0				2	2	
Otter Trawl	15	10.20		32	7			111		0				2	1	

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat (total number of deployments) for Segment 8 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	Mesohabitat					
			BAR	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1 Inch Trammel Net	15	19.27		289	N-E	N-E	0	N-E
Gill Net	19	9.84		94			93	
Otter Trawl	15	9.53		143			0	
Summer – Fish Community Season								
1 Inch Trammel Net	15	20.07		301	N-E	N-E	0	N-E
Mini-Fyke Net	15	8.00	111	9			0	
Otter Trawl	15	10.20		153			0	

Pallid Sturgeon

A total of 34 pallid sturgeon were sampled in Segment 8 during the 2007 sampling season. Thirty of the fish were of known hatchery origin and four were classified as wild via genetic confirmation. More pallid sturgeon were sampled during the fish community season (N=19) than the sturgeon season (N=15) in 2007. In previous years, very few pallid sturgeon were sampled during the fish community season

Pallid sturgeon were captured throughout the entire reach of Segment 8 ranging from Lower Ponca bend (R.M. 753.0) downstream to Papillion bend (R.M. 596.0). The greatest number of pallid sturgeon captured on any bend was from Upper Sioux City bend (R.M. 734.7). During the fish community season, six pallid sturgeon were sampled from this bend at the confluence of the Big Sioux River, which is the most pallid sturgeon that have been sampled from one bend in Segment 8. One additional pallid sturgeon was sampled on this bend during the sturgeon season. Omaha bend (R.M. 614.6) and Boyer bend (R.M. 637.1) had the next highest catches of pallid sturgeon (N=4 and 3, respectively) (Figure 1b).

Most pallid sturgeon (58%; N=19) were captured from the inside bend macrohabitat in 2007, which was similar to previous years (Hamel and Steffensen 2007; Table 3). Within the inside bend, most pallid sturgeon were sampled from channel border mesohabitats (86%). Mean depth, mean bottom velocity, mean temperature, and mean turbidity from channel border habitats where pallid sturgeon were captured did not differ from the average of all samples collected. Pallid sturgeon captured in pool mesohabitats within the inside bend were found in shallower mean depths (3.4 m vs. 4.1 m), slower bottom velocities (0.22 m/s vs. 0.31 m/s), higher mean temperatures (9.9°C vs. 8.1°C), and greater mean turbidities (132 ntu vs. 81 ntu) than the average of all habitats sampled. This is contrary to previous years, where pallid sturgeon were typically sampled in greater water depths and turbidities and similar bottom velocities and temperatures (Hamel and Steffensen 2007).

Six year classes (2001-2006) of hatchery reared pallid sturgeon that have been stocked into RPMA #4 were recaptured in 2007 (Table 6). All fish increased in length since stocking and appeared to be in good health. The mean relative condition factor (Kn) for all year classes of recaptured fish ranged from 0.85 to 1.18. Most hatchery and wild pallid sturgeon collected in 2007 (73%) were of stock size (330-629 mm). Two pallid sturgeon were of quality size and one fish was in the preferred size category. During the fish

community season, five sub-stock pallid sturgeon (200-329 mm) were collected; however, all of these fish were of hatchery origin. Relative condition appeared to be lower during the sturgeon season and varied little between length categories (Table 7). The general trend observed was that relative condition decreased slightly as fish grew in size.

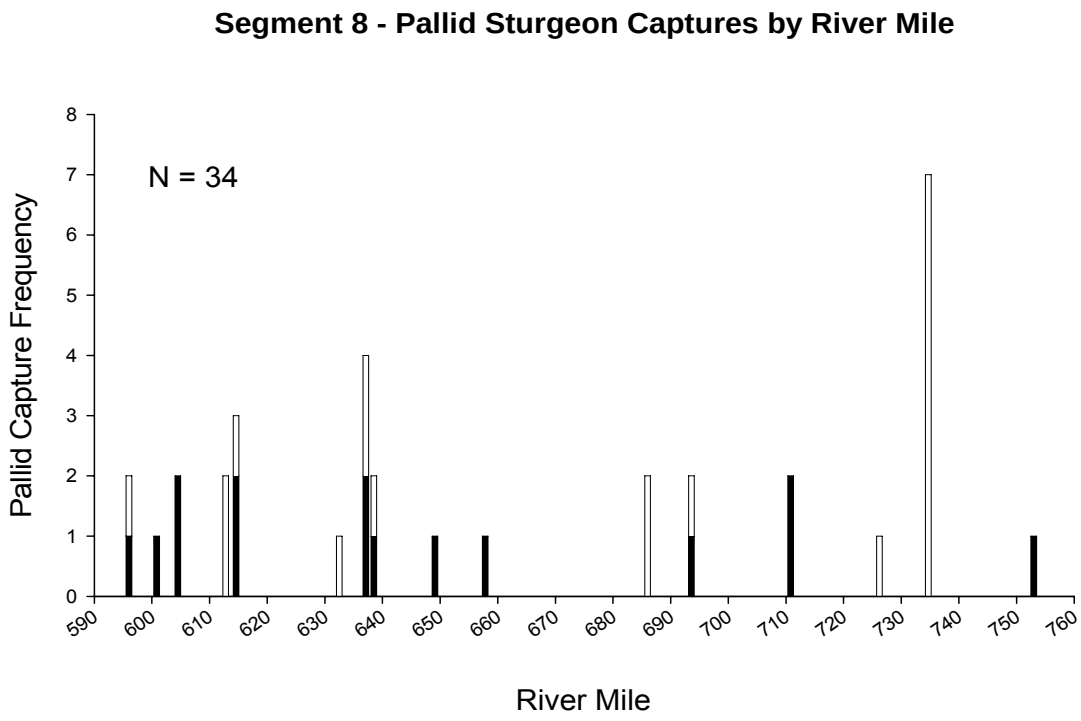

Figure 1b. Distribution of pallid sturgeon captures by river mile for Segment 8 of the Missouri River during 2006-2007. Black bars represent pallid captures during sturgeon season and white bars during fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2007. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
CHXO	BAR	0.5 (0.3-1.0)		0.11 (0.01-0.55)		25.1 (16.5-27.9)		105 (22-409)		.
	CHNB	2.4 (0.3-5.7)	2.5 (2.2-3.0)	0.61 (0.08-1.23)	0.65 (0.65-0.65)	21.4 (0.7-29.0)	20.3 (12.5-24.4)	74 (10-627)	76 (47-111)	3
	POOL	3.1 (1.4-7.1)	4.7 (4.7-4.7)	0.39 (0.03-0.71)		8.4 (1.2-27.2)	12.6 (12.6-12.6)	88 (10-627)	140 (140-140)	1
CONF	CHNB	4.0 (2.5-4.6)	4.4 (4.4-4.4)	0.63 (0.55-0.71)	0.71 (0.71-0.71)	24.3 (16.8-27.9)	27.8 (27.8-27.8)	52 (32-73)	43 (43-43)	6
ISB	BAR	0.5 (0.1-1.5)		0.10 (0.00-0.29)		25.2 (16.5-27.9)		108 (23-409)		.
	CHNB	2.3 (0.2-5.7)	2.1 (1.2-3.9)	0.61 (0.10-1.25)	0.62 (0.15-0.94)	21.5 (0.7-29.8)	22.3 (12.1-27.5)	78 (10-609)	86 (20-305)	19
	POOL	4.1 (1.3-9.3)	3.4 (2.5-5.0)	0.31 (0.13-0.61)	0.22 (0.15-0.29)	8.1 (0.7-27.8)	9.9 (8.3-12.6)	81 (10-627)	132 (27-220)	3
OSB	BAR	0.7 (0.4-1.1)				26.2 (24.6-27.5)				.
SCCL	CHNB	2.3 (2.3-2.3)	2.3 (2.3-2.3)	0.51 (0.51-0.51)	0.51 (0.51-0.51)	21.1 (21.1-21.1)	21.1 (21.1-21.1)	77 (77-77)	77 (77-77)	1

Table 6. Mean fork length, weight, relative condition factor (Kn), growth rates, and water temperature for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2007 from Segment 8 of the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year.

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
2001	8	204			494	428.0	0.85	0.15	
		18			56	179.1	0.12	0.03	
2002	3	273			400	247.3	1.16	0.07	
		20			42	97.8	0.72	0.02	
2003									
2004	1				399	196.0	0.87		
2005	9	327	155	1.29	384	188.4	0.93	0.25	0.11
		17	34	0.07	21	38.5	0.05	0.12	0.06
2006	4				243	53.5	1.18		
					47	29.0	0.19		

Table 7. Incremental relative stock density (RSD)[a] and relative condition factor (Kn) for all pallid sturgeon captured with all gear by a length category during 2007 in the Missouri River. Length categories[b] determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993).

Length Category	N	RSD	Kn (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199)			
Sub-stock (200-329)	1		1.31
Stock	11	79	0.84 (0.06)
Quality	1	14	0.79
Preferred	1	8	0.82
Memorable			
Trophy			
Overall Kn			0.87 (0.08)
Fish Community Season			
Sub-stock (0-199)			
Sub-stock (200-329)	5		1.20 (0.23)
Stock	13	68	0.98 (0.17)
Quality	1	7	0.92
Preferred			
Memorable			
Trophy			
Overall Kn			1.036 (0.132)

[a] RSD = (# of fish of a specified length class / # of fish ≥ minimum stock length fish) * 100.
[b] Length categories based on the percentage of the largest known pallid sturgeon: Sub-stock FL < 330 mm (20 %), Stock FL =330 - 629 mm (20 – 36 %), Quality FL = 630 – 839 mm (36 – 45 %), Preferred FL = 840 – 1039 mm (45 – 59 %), Memorable FL = 1040 – 1269 mm (59 – 74 %), Trophy FL > 1270 mm (>74 %).

Year comparisons, Gear evaluation and Habitat associations

A total of 34 hatchery-reared and wild pallid sturgeon were captured in trammel nets (N=17), otter trawls (N=11), gill nets (N=5), and 2.5" monofilament gill nets (Non-standard gear; N=1) during the 2007 sampling season. Otter trawls had the highest overall mean annual CPUE (0.035 fish per 100 m trawled) (Appendix F1). Wild pallid sturgeon were only captured with gill nets during the sturgeon season and with trammel nets during the fish community season (Figures 2-5). Catch rates of pallid sturgeon varied seasonally among these gears. Both trammel nets and otter trawls had higher catch rates of pallid sturgeon during the fish community season (Appendix H). Although statistical comparisons were not made for catch rates between years, CPUE of pallid sturgeon in trammel nets has increased for both seasons since 2005 (Hamel and Steffensen 2007). Otter trawl catch rates during the sturgeon season have decreased since 2005; however, CPUE nearly doubled during the fish community season in 2007 (Hamel and Steffensen 2007). Gill net CPUE had remained constant since 2005 in Segment 8.

There were no pallid sturgeon less than 200 mm sampled in 2007 (Table 7). There were two sub-stock size (200-329 mm) pallid sturgeon captured with otter trawls within the inside bend and channel crossover macrohabitat during the fish community season (Table 11). Trammel nets collected three sub-stock size fish (200-329 mm) and were sampled on the inside bend macrohabitat during the fish community season. Only one sub-stock (200-329 mm) pallid sturgeon was sampled during the sturgeon season and was captured with an otter trawl within the inside bend macrohabitat (Table 12).

Stock sized (330-629 mm) pallid sturgeon continue to be the most common size category captured. All but three of these fish (87%) were captured within the inside bend macrohabitat, which is where approximately 75% of all sampling took place (Table 13). Gill nets were the only gear that collected pallid sturgeon in a mesohabitat other than channel border mesohabitat (Table 14). During the fish community season, all stock sized pallid sturgeon sampled with trammel nets (N=6) were collected in the channel border mesohabitat within the inside bend macrohabitat; however, stock sized pallid sturgeon collected with otter trawls (N=7) were disproportionately sampled within the confluence macrohabitat. All but one of these pallid sturgeon were caught on duplicate samples within the confluence of the

Big Sioux River near Sioux City, IA (R.M. 734.0). This macrohabitat is limited due to the finite number of large tributaries to the Missouri River; therefore, very few samples have been collected in this habitat type. Only two quality-sized and above (>629 mm) pallid sturgeon were sampled with standard gears in 2007. Both of these fish were sampled within the inside bend macrohabitat; one with gill nets during the sturgeon season and one with trammel nets during the fish community season (Table 15).

Pallid sturgeon collected during the sturgeon season ranged from 202 to 1,007 mm, while pallid sturgeon caught during the fish community season ranged from 202 to 661 mm (Figure 8). On average, a significantly larger size distribution of pallid sturgeon were caught during the sturgeon season when compared to the fish community season ($D = 0.82$; $P = 0.004$). Hatchery reared pallid sturgeon were sampled more frequently than wild pallid sturgeon, which was similar to 2005 and 2006 (Figure 9). In general, wild pallid sturgeon (Mean length = 706 mm) were larger than hatchery reared pallid sturgeon (Mean length = 398 mm).

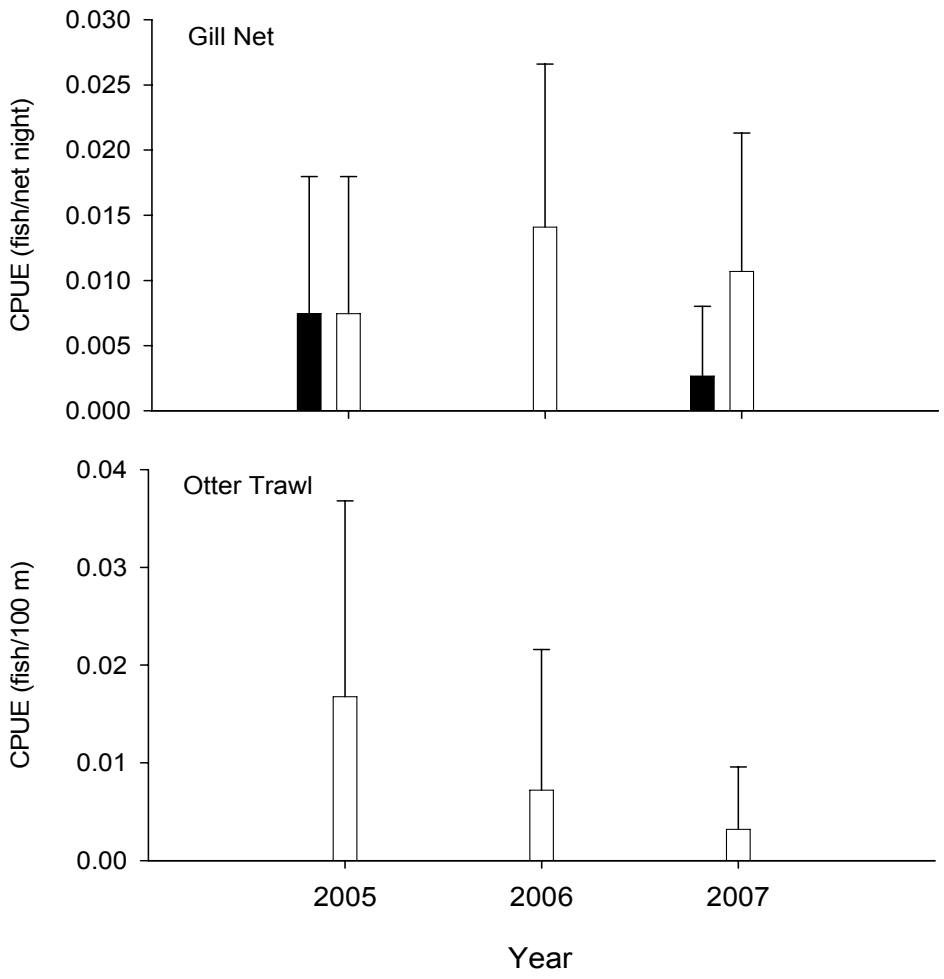

Figure 2. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in Segment 8 of the Missouri River during sturgeon season 2005-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

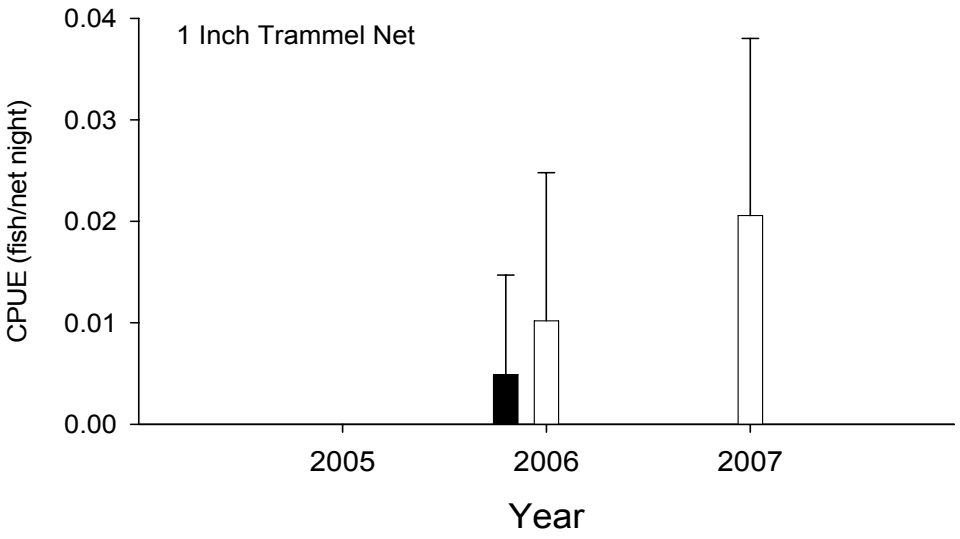

Figure 3. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1-inch trammel nets in Segment 8 of the Missouri River during sturgeon season 2005-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Segment 8 - Pallid Sturgeon / Fish Community Season

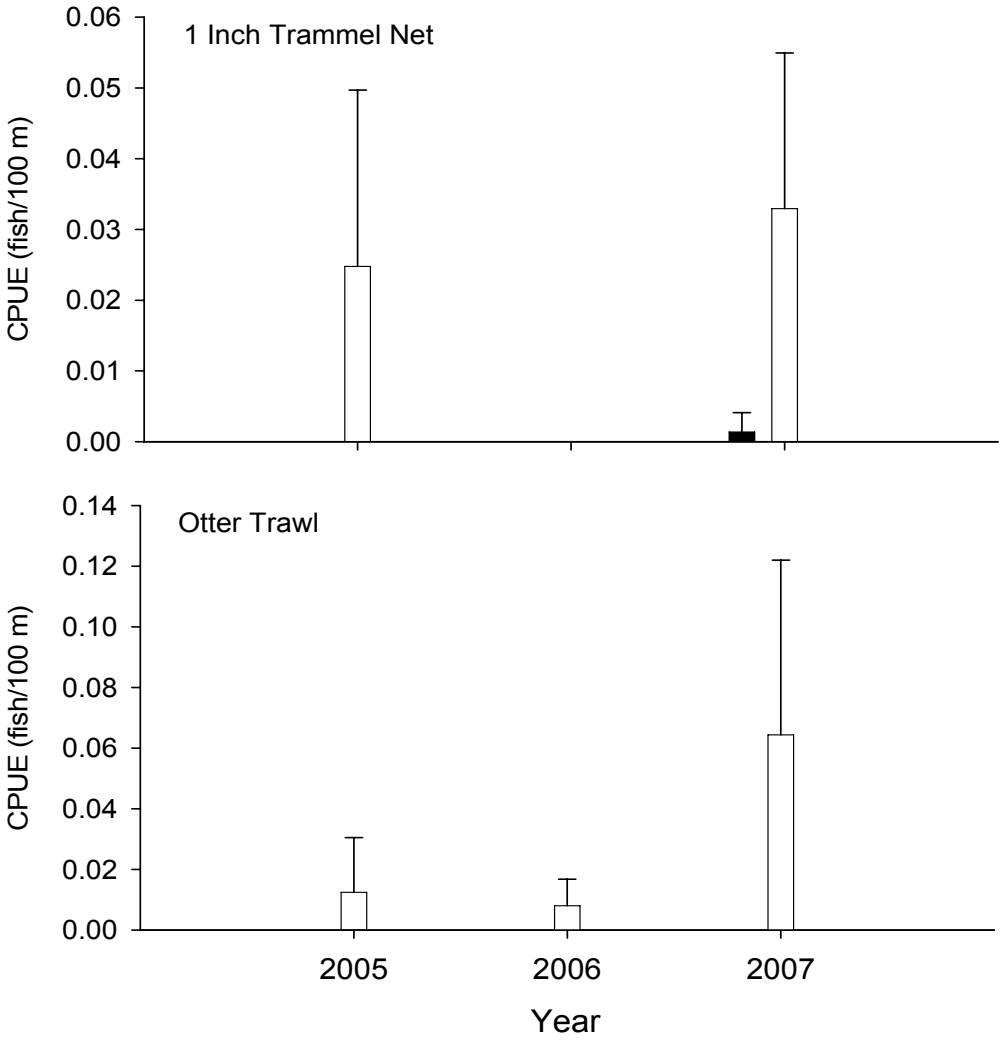

Figure 5. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1-inch trammel nets and otter trawls in Segment 8 of the Missouri River during fish community season 2005-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Table 11. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	N-E	20	1	N-E	N-E	78		1	N-E					
Gill Net	0		21				79								
Otter Trawl	1		19	1			100 78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	3	N-E	19	1	N-E	N-E	100 79			N-E			1	1	
Mini-Fyke Net	0		25				72						2	2	
Otter Trawl	2		50 19	4			50 76						1		

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0		100				
Gill Net	0		50			50	
Otter Trawl	1		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	3		100 100				
Mini-Fyke Net	0	100					
Otter Trawl	2		100 100				

Table 13. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	6	N-E	17 20	1	N-E	N-E	67 78		17 1	N-E	N-E				
Gill Net	4		25 21				75 79								
Otter Trawl	0		19	1			78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	6	N-E	19	1	N-E	N-E	100 79			N-E	N-E		1	1	
Mini-Fyke Net	0		25				72						2	2	
Otter Trawl	7		19	86 4			14 76						1		

Table 14. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	6		100 100	N-E	N-E		
Gill Net	4		25 50			75 50	
Otter Trawl	0		100				
Fish Community Season (Summer)							
1 Inch Trammel Net	6		100 100	N-E	N-E		
Mini-Fyke Net	0	100	8				
Otter Trawl	7		100 100				

Table 15. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	N-E	20	1	N-E	N-E	78		1	N-E	N-E				
			21				100								
Gill Net	1						79								
Otter Trawl	0		19	1			78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	1	N-E	19	1	N-E	N-E	100			N-E	N-E		1	1	
							79								
Mini-Fyke Net	0		25				72						2	2	
Otter Trawl	0		19	4			76						1		

Table 16. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0		100	N-E	N-E		
Gill Net	1		50			100 50	
Otter Trawl	0		100				
Fish Community Season (Summer)							
1 Inch Trammel Net	1		100 100	N-E	N-E		
Mini-Fyke Net	0	100					
Otter Trawl	0		100				

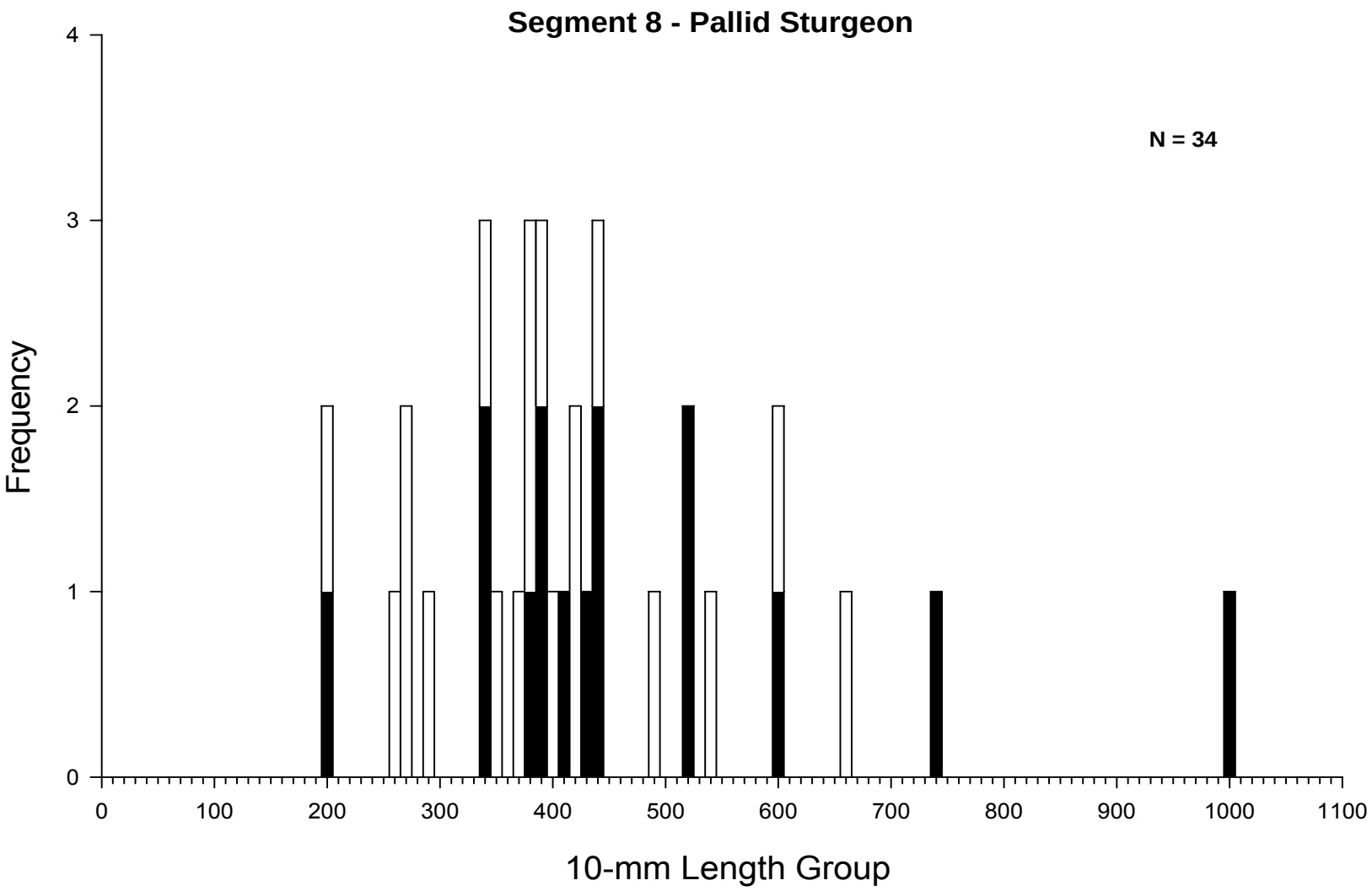

Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in Segment 8 of the Missouri River during 2007 including non-random and wild samples.

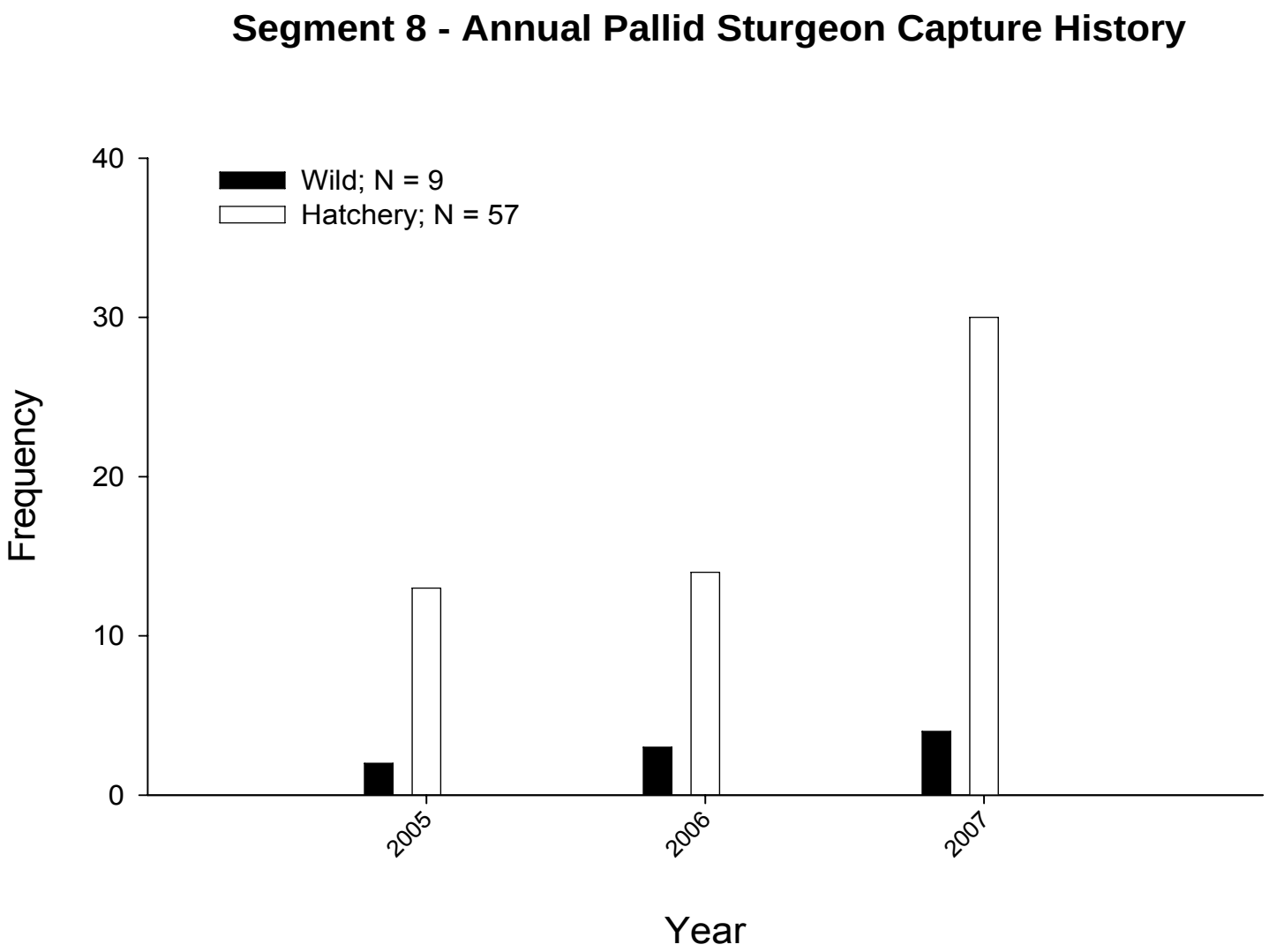

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 8 of the Missouri River from 2005-2007. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Targeted Native River Species

Shovelnose Sturgeon

A total of 2,673 shovelnose sturgeon were captured in gill nets (N=1,367), trammel nets (N=1,153), and otter trawls (N=153) in Segment 8 during 2007. An additional 134 shovelnose sturgeon were collected with non-standard 2.5" monofilament gill nets (N=133) and push trawls (N=1). Overall CPUE was highest in gill nets (3.66 fish per net night) followed by trammel nets (2.07 fish per 100 m drifted) and otter trawls (0.47 fish per 100 m trawled) (Appendix F). No shovelnose sturgeon have been collected with mini-fyke nets in Segment 8.

Gill nets were the most effective gear during the sturgeon season (CPUE = 3.66 fish per net night) (Figures 11 and 12; Appendix H), which was similar to 2005 (Barada and Steffensen 2006) and 2006 (Hamel and Steffensen 2007). Trammel nets had the highest CPUE during the fish community season in 2007 (1.96 fish per 100 m sampled), which was similar to catch rates observed in 2005 (2.27 fish per 100 m drift; Barada and Steffensen 2006) (Figure 14; Appendix H), but much higher than those observed in 2006 (0.7 fish per 100 m drift; Hamel and Steffensen 2007).

No standard gears were effective at sampling sub-stock (0–149 mm and 150–249 mm) size shovelnose sturgeon (Table 17-20; Figure 11-14; Hamel and Steffensen 2007). There was a significant increase in CPUE of stock size (250-379 mm) shovelnose sturgeon with otter trawls during the fish community and sturgeon seasons and with trammel nets during the sturgeon season compared to 2005 and 2006 (χ^2 = 9.53, 16.51, and 58.05, respectively; DF = 2; $P < 0.009$) (Table 21 and 22). Quality and above size (>380 mm) shovelnose sturgeon continue to be the most abundant size category sampled with standard gears. Gill nets had the highest CPUE (3.62 fish per net night) for quality and above size shovelnose sturgeon during the sturgeon season and was significantly higher than 2005 and 2006 (χ^2 = 13.83; DF = 2; $P = 0.001$). In addition, trammel nets displayed a significant increase in mean CPUE during the sturgeon and fish community seasons compared to 2006 (χ^2 = 33.32, 77.21, respectively; DF = 2; $P < 0.0001$) (Figures 11-14). Catch rates of quality and above size shovelnose sturgeon with otter trawls was similar to previous years (Figures 11-14).

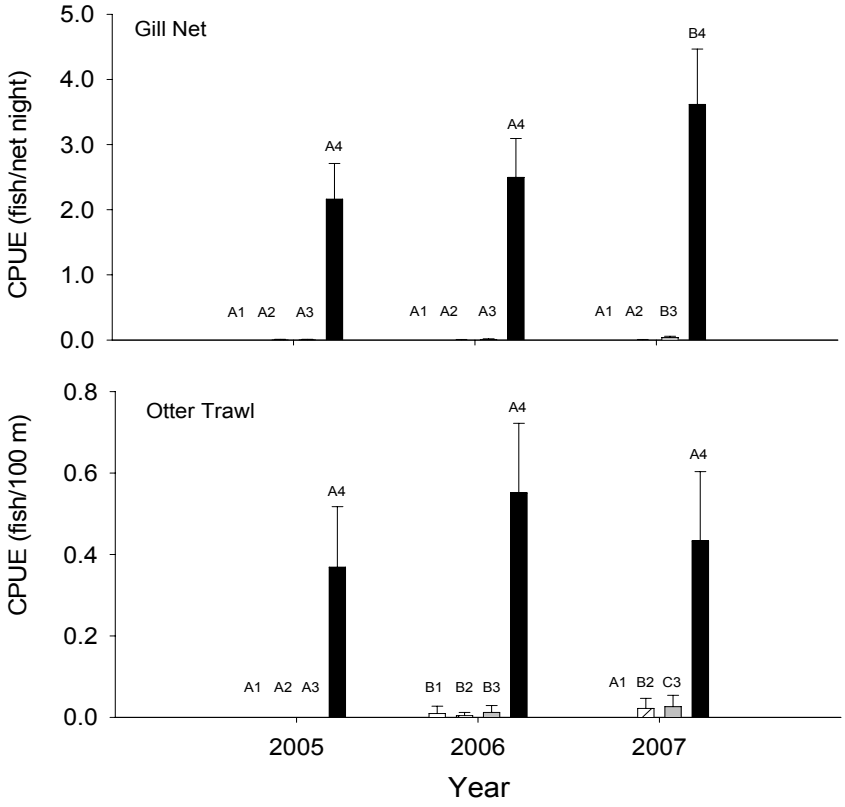

Figure 11. Mean annual catch-per-unit-effort (+/- 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significant differences between years for each size class of shovelnose sturgeon.

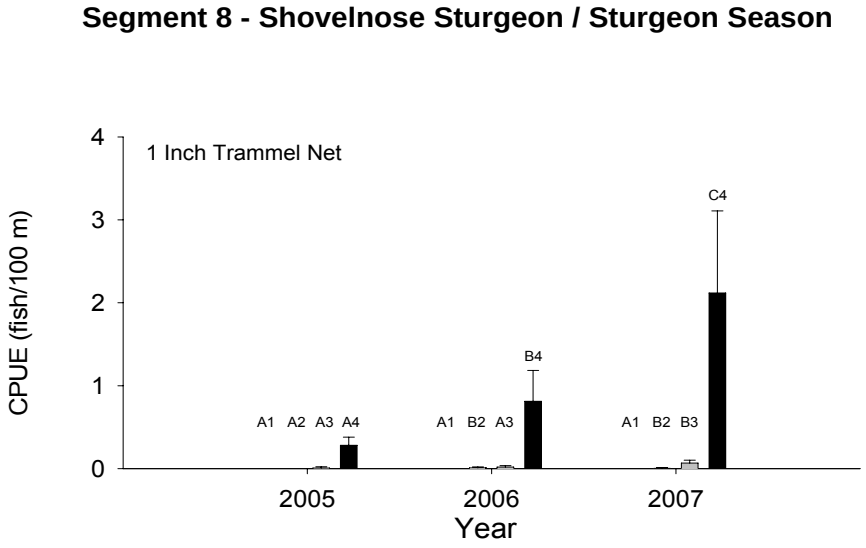

Figure 12. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (>= 380 mm; black bars) shovelnose sturgeon using 1-inch trammel nets in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significant differences between years for each size class of shovelnose sturgeon.

Segment 8 - Shovelnose Sturgeon / Fish Community Season

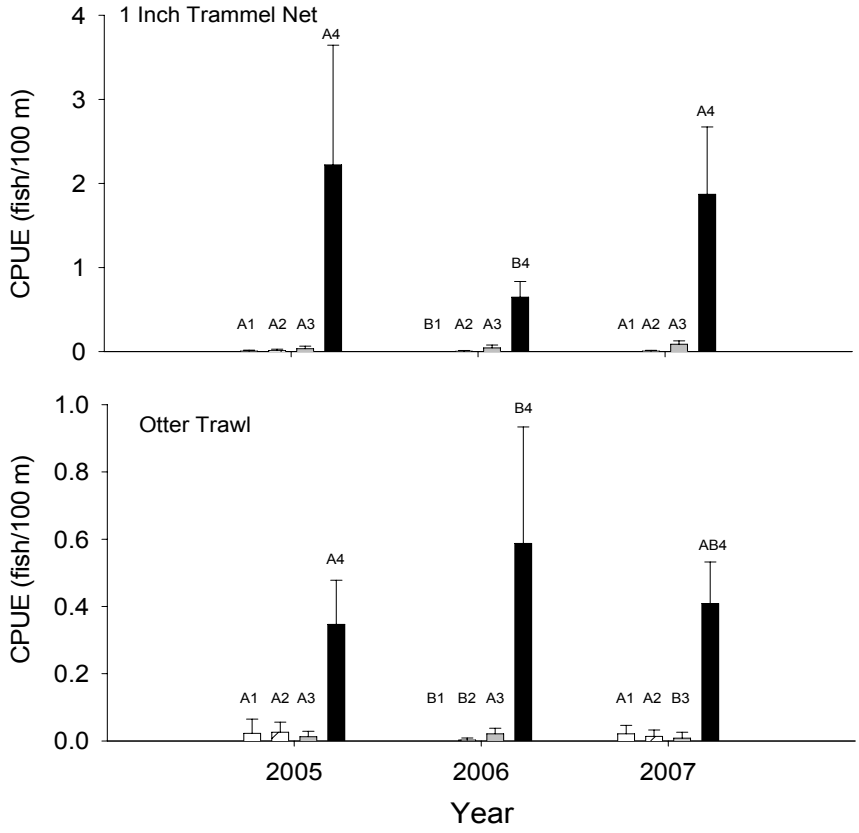

Figure 14. Mean annual catch-per-unit-effort (+/- 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (>= 380 mm; black bars) shovelnose sturgeon using 1-inch trammel nets and otter trawls in Segment 8 of the Missouri River during fish community season 2005-2007. Letters denote significant differences between years for each size class of shovelnose sturgeon.

Habitat Use

Very few sub-stock (0–149 mm and 150–249 mm; N=13) and stock size (250-379 mm; N=60) shovelnose sturgeon were captured compared to quality and above size (>380 mm; N=2,590) fish in 2007. There were four shovelnose sturgeon caught that were in the 0-149 mm category and were sampled in the channel border mesohabitat within the channel cross-over and inside bend macrohabitat (Tables 17 and 18). All sub-stock (150-249 mm) and stock-sized fish were caught in channel borders and pools within the inside bend and channel crossover macrohabitat during the sturgeon and fish community season (Tables 19-22). There were many quality size and greater (≥380 mm) shovelnose sturgeon sampled during the sturgeon season (N=1,975). Nearly half of these fish (46%) were sampled with gill nets on the inside bend and channel cross-over macrohabitats. All three standard gears used during the fish community season (i.e., gill nets, trammel nets, and otter trawls) sampled shovelnose sturgeon in similar proportion to where the sampling effort was located. Within a macrohabitat, gill nets were the only gear to sample more than one mesohabitat (Table 23 and 24). Although the amount of sampling effort was split between channel border (50%) and pool mesohabitats, more fish (67%) were caught in pools ($\chi^2 = 5.95$; DF = 1; $P = 0.015$).

Fewer shovelnose sturgeon were collected during the fish community season; however, gill nets were not used during this season. Trammel nets and otter trawls caught similar numbers of shovelnose sturgeon during the sturgeon season. Trammel nets were the most effective gear for sampling shovelnose sturgeon in the fish community season and 94% of these fish came from inside bend macrohabitat. Only 6% of shovelnose sturgeon were sampled in the channel crossover, which was significantly less than the amount of sampling effort (~ 20%) that occurs in this macrohabitat type ($\chi^2 = 11.06$; DF = 4; $P = 0.026$). Conversely, otter trawls caught fewer shovelnose sturgeon from inside bends and more from channel crossovers compared to the amount of sampling effort that occurs in these macrohabitat types ($\chi^2 = 10.68$; DF = 3; $P = 0.014$) (Tables 23 and 24).

The length range for all shovelnose sturgeon collected in 2007 was between 172 to 808 mm for the sturgeon season and 51 to 731 mm for the fish community season (Figure 17). There was a significant difference in the length frequency distribution between sampling seasons. The fish community season displayed a greater size distribution of shovelnose sturgeon; however, this is likely due to the increase in effort with sampling gears that are more conducive to

sampling smaller sized individuals ($D = 0.346$; $P = 0.0042$). The length-frequency distribution from 2007 (Figure 17) is notably similar to those in 2005 and 2006 (Hamel and Steffensen 2007; Barada and Steffensen 2006). Most shovelnose sturgeon collected were between 450 to 650 mm with very few small fish being collected with any gear.

Table 17. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	N-E	20	1	N-E	N-E	78		1	N-E	N-E				
Gill Net	0		21				79								
Otter Trawl	0		19	1			78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	19	1	N-E	N-E	79			N-E	N-E		1	1	
Mini-Fyke Net	0		25				72						2	2	
Otter Trawl	4		25 19	4			75 76						1		

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0		100	N-E	N-E		
Gill Net	0		50			50	
Otter Trawl	0		100				
Fish Community Season (Summer)							
1 Inch Trammel Net	0		100	N-E	N-E		
Mini-Fyke Net	0	100					
Otter Trawl	4		100 100				

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	1	N-E	20	1	N-E	N-E	100 78		1	N-E	N-E				
Gill Net	1		21				100 79								
Otter Trawl	3		33 19	1			67 78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	2	N-E	19	1	N-E	N-E	100 79			N-E	N-E		1	1	
Mini-Fyke Net	0		25				72						2	2	
Otter Trawl	2		19	4			100 76						1		

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	1		100 100				
Gill Net	1		 50	N-E	N-E	100 50	
Otter Trawl	3		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	2		100 100				
Mini-Fyke Net	0	 100		N-E	N-E		
Otter Trawl	2		100 100				

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	17	N-E	24 20	1	N-E	N-E	76 78		1	N-E	N-E				
Gill Net	14		21 21				79 79								
Otter Trawl	4		19	1			100 78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	24	N-E	4 19	1	N-E	N-E	96 79			N-E	N-E		1	1	
Mini-Fyke Net	0		25				72						2	2	
Otter Trawl	1		100 19	4			76						1		

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	17		100 100	N-E	N-E		
Gill Net	14		43 50			57 50	
Otter Trawl	4		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	24		100 100	N-E	N-E		
Mini-Fyke Net	0	100					
Otter Trawl	1		100 100				

Table 23. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	557	N-E	8 20	2 1	N-E	N-E	90 78		1	N-E	N-E				
Gill Net	1352		19 21				81 79								
Otter Trawl	66		33 19	 1			65 78						2 1		
Fish Community Season (Summer)															
1 Inch Trammel Net	550	N-E	6 19	 1	N-E	N-E	94 79			N-E	N-E		1	1	
Mini-Fyke Net	0		 25				 72						2	2	
Otter Trawl	65		22 19	17 4			62 76						1		

Table 24. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	557		100 100	N-E	N-E		
Gill Net	1352		33 50			67 50	
Otter Trawl	66		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	550		100 100	N-E	N-E		
Mini-Fyke Net	0	100					
Otter Trawl	65		100 100				

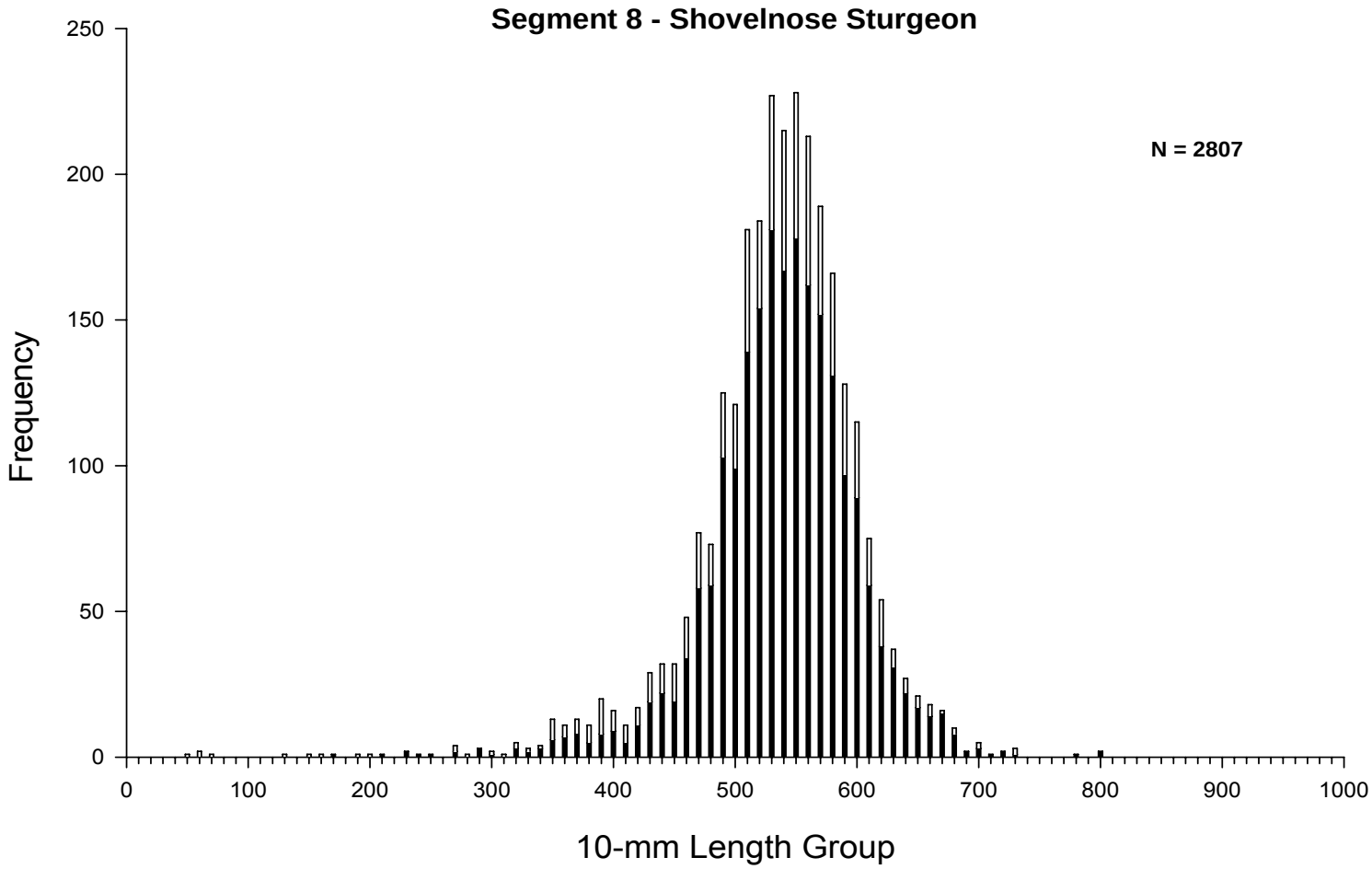

Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in Segment 8 of the Missouri River during 2007.

Table 25. Incremental relative stock density (RSD)[a] and mean relative weight (Wr) by a length category for shovelnose sturgeon in Segment 8 of the Missouri River captured during 2007. Length categories[b] determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2SE)
Sturgeon Season			
Sub-stock (0-149 mm)			
Sub-stock (150-249 mm)	5		106.6 (19.02)
Stock	35	2	97.89 (14.65)
Quality	427	21	90.93 (2.11)
Preferred	1480	73	85.03 (0.49)
Memorable	68	3	80.78 (2.65)
Trophy			
Overall Wr			86.41 (0.65)
Fish Community Season			
Sub-stock (0-149 mm)	4		
Sub-stock (150-249 mm)	4		136.3 (57.22)
Stock	25	4	114.4 (30.08)
Quality	161	25	88.86 (4.33)
Preferred	434	68	82.70 (0.81)
Memorable	20	3	82.90 (3.59)
Trophy			
Overall Wr			85.65 (1.73)

[a] RSD = (# of fish of a specified length class / # of fish ≥ minimum stock length fish) * 100.

[b] Length categories based on the percentage of the largest known shovelnose sturgeon: Sub-stock FL < 250 mm (20 %), Stock FL =250-379 mm (20 – 36 %), Quality FL = 380 – 509 mm (36 – 45 %), Preferred FL = 510 - 639 mm (45 – 59 %), Memorable FL = 640 – 809 mm (59 – 74 %), Trophy FL > 810 mm (>74 %).

Sturgeon Chub

A total of three sturgeon chub were captured with standard gears during the 2007 sampling season. All three fish were captured in the standard otter trawl during the fish community season. Catch per unit effort for otter trawls was 0.017 fish per 100 m trawled (Appendix H). The average length of the sturgeon chub sampled was 76 mm with a length range of 71 to 79 mm. Due to the low number of fish sampled habitat associations were not made.

Sicklefin Chub

Only one sicklefin chub was captured with standard gears (i.e., OT16 trawl) during the 2007 sampling season. An additional three fish were sampled with the experimental push trawl (POT02E). All of the sicklefin chub were sampled during the fish community season. Catch per unit effort for otter trawls during the fish community season was 0.005 fish per 100 m trawled (Appendix H). The single sicklefin chub sampled with the OT16 trawl was 102 mm. The average length of the sicklefin chub sampled with push trawls was 24 mm with a length range of 22 to 27 mm. Due to the low number of fish sampled habitat associations were not made.

Speckled Chub

A total of 80 speckled chub were captured in standard otter trawls (N=78) and mini-fyke nets (N=2) during the 2007 sampling season. An additional 13 speckled chub were sampled with the experimental push trawl (POT02E) and were not included in this analysis. Catch per unit effort for standard otter trawls during the sturgeon season was 0.28 fish per 100 m trawled (Figure 26). There were no significant differences in mean CPUE compared to 2006 ($\chi^2 = 0.53$; $P = 0.467$); however, CPUE values from 2006 and 2007 were significantly greater than 2005 ($\chi^2 = 4.11$, 7.33, respectively; $P < 0.0425$). During the fish community season, otter trawls again had the highest CPUE (0.16 fish per 100 m trawled) followed by mini-fyke nets (0.02 fish per net night) (Figures 27 and 28). There were no significant differences in CPUE for speckled chub between otter trawls ($\chi^2 = 4.03$; DF = 2; $P = 0.133$) and mini-fyke nets ($\chi^2 = 0.90$; DF = 2; $P = 0.637$) among years.

All speckled chub collected during the sturgeon season were sampled from the channel border mesohabitat within the inside bend or channel cross-over macrohabitats (Tables 30 and 31). Although 23% of all sampling with the otter trawl occurred within the channel cross-over macrohabitat, 94% of speckled chub that were collected during the sturgeon season occurred in the inside bend ($\chi^2 = 9.23$; DF = 2; $P = 0.001$). All speckled chub were collected from the same macrohabitat during the fish community season. Only two speckled chub were captured with mini-fyke nets from bar habitat within the inside bend. The remaining speckled chub were collected in otter trawls (N=21) and were sampled proportionately to where the sampling effort was directed ($\chi^2 = 0.031$; DF = 1; $P = 0.860$).

The average length of speckled chub was 44.9 mm during the sturgeon season and 40.4 mm during the fish community season (Figure 29). The length range for speckled chub sampled during the sturgeon season was 25 to 66 mm and 26 to 62 mm during the fish community season. Contrary to previous years, more speckled chub were sampled during the sturgeon season (N=57) than the fish community season (N=36) (Hamel and Steffensen 2007; Barada and Steffensen 2006).

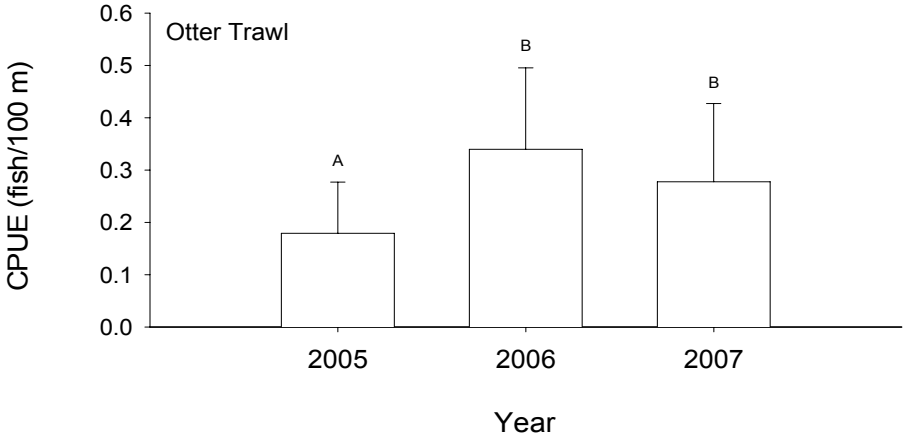

Figure 26. Mean annual catch-per-unit-effort (+/- 2 SE) of speckled chub using otter trawls in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significan differences in mean CPUE between years.

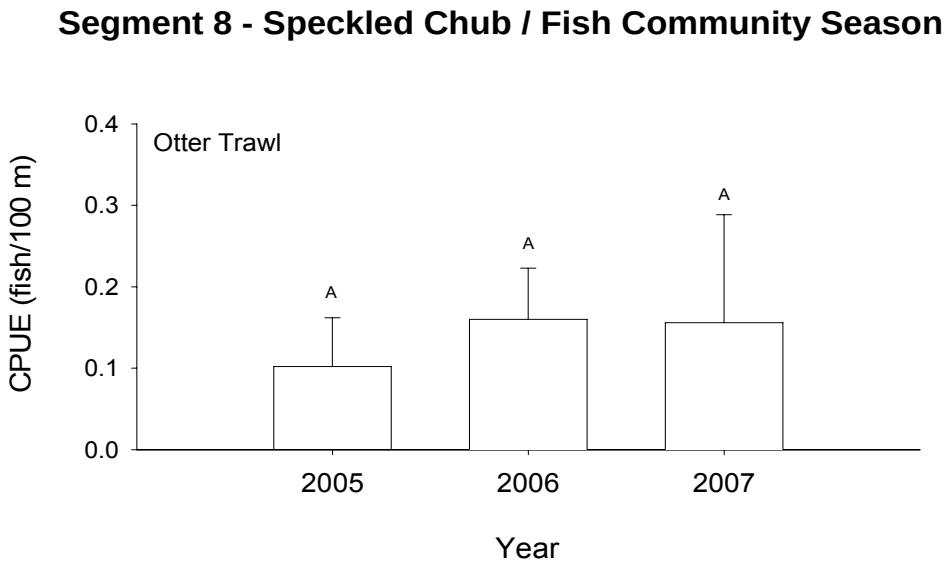

Figure 27. Mean annual catch-per-unit-effort (+/- 2 SE) of speckled chub in Segment 8 of the Missouri River during fish community season 2005-2007. Letters denote significant differences in mean CPUE between years.

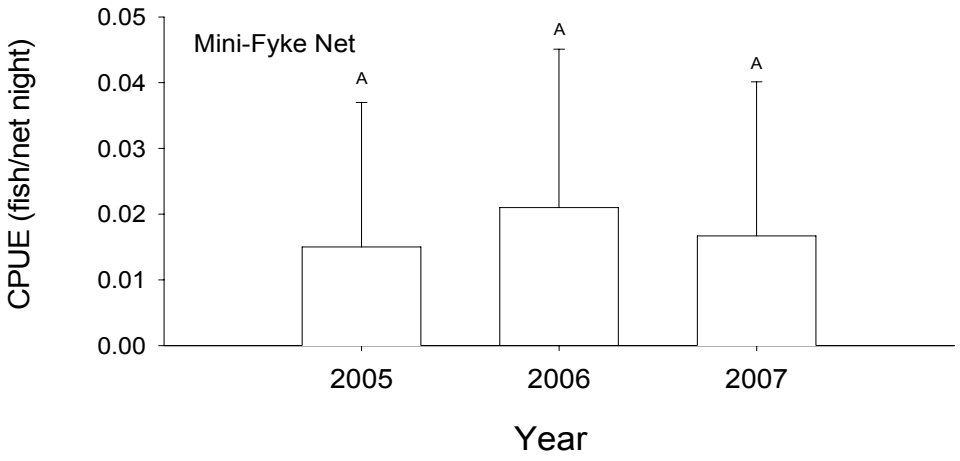

Figure 28. Mean annual catch-per-unit-effort (+/- 2 SE) of speckled chub using mini-fyke nets in Segment 8 of the Missouri River during fish community season 2005-2007. Letters denote significant differences in mean CPUE between years.

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	N-E	20	1	N-E	N-E	78		1	N-E	N-E				
Gill Net	0		21				79								
Otter Trawl	51		6 19	1			94 78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	19	1	N-E	N-E	79			N-E	N-E		1	1	
Mini-Fyke Net	2		25				100 72						2	2	
Otter Trawl	21		19 19	4			81 76						1		

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0		100	N-E	N-E		
Gill Net	0		50			50	
Otter Trawl	51		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	0		100	N-E	N-E		
Mini-Fyke Net	2	100 100					
Otter Trawl	21		100 100				

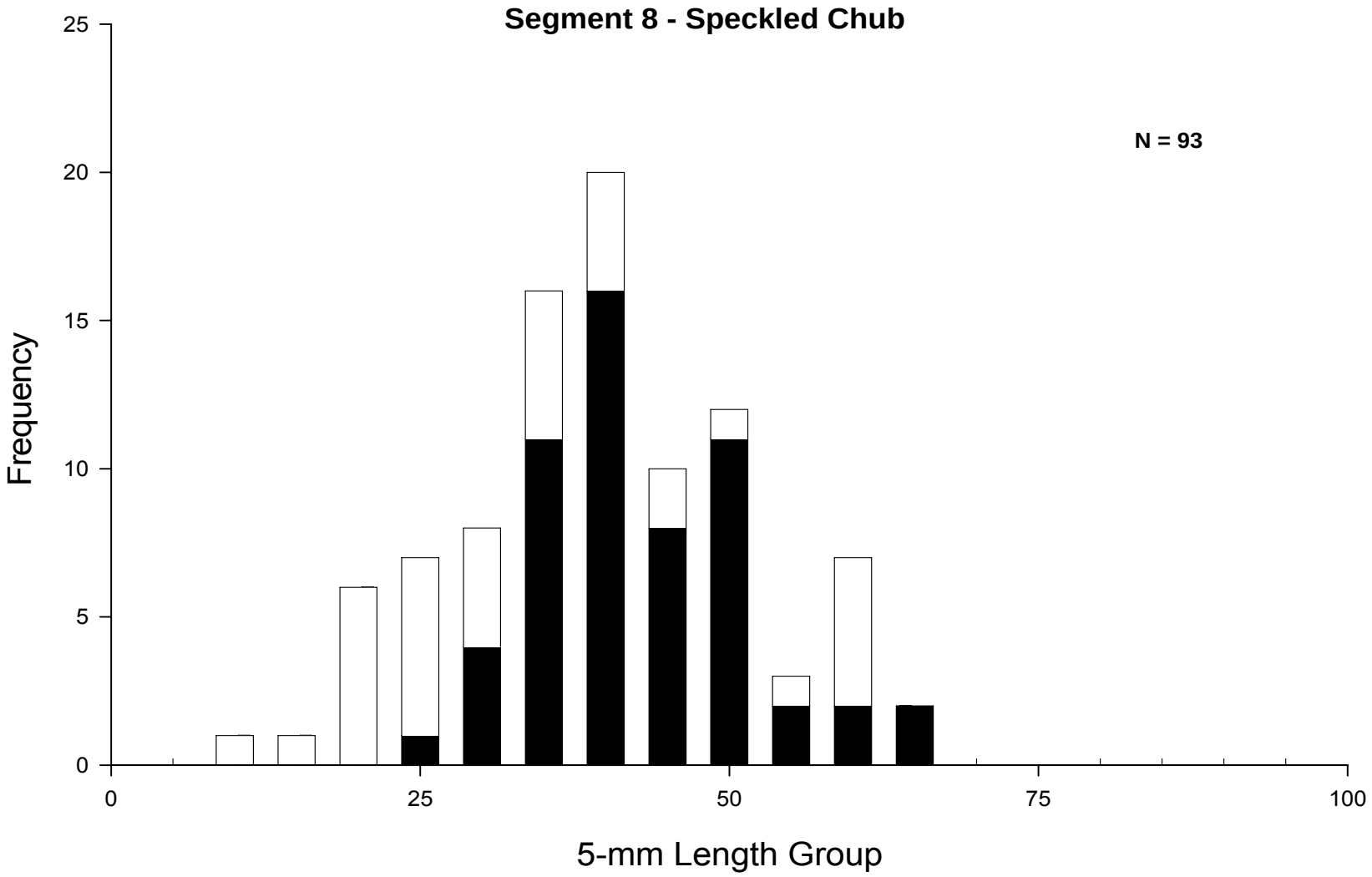

Figure 29. Length frequency of speckled chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in Segment 8 of the Missouri River during 2007.

Sand Shiner

A total of 435 sand shiners were captured in mini-fyke nets (N=406) and otter trawls (N=29) during the 2007 sampling season. An additional 24 fish were sampled in the experimental push trawl (POT02E) and were not included in this analysis. Catch per unit effort for otter trawls during the sturgeon season was 0.21 fish per 100 m trawled (Figure 30), which was significantly higher than 2005 and 2006 ($\chi^2 = 95.29$; DF = 2; $P < 0.0001$). During the fish community season, mini-fyke nets had the highest CPUE (3.38 fish per net night) of sand shiners followed by otter trawls (0.02 fish per 100 m trawled) (Figure 31 and 32). Catch rates of sand shiners with mini-fyke nets were significantly lower than they were in 2006 ($\chi^2 = 33.26$; DF = 1; $P < 0.0001$). Otter trawls catch rates were similar to those in 2006 ($\chi^2 = 0.81$; DF = 2; $P = 0.369$).

The majority of sand shiners (99.5%) were collected during the fish community season in mini-fyke nets (Table 32). Nearly 75% of all mini-fyke nets were deployed within the inside macrohabitat and channel crossovers comprised the remaining 25% (Table 32). Although most deployments were within the inside bend, catch rates were significantly greater within the channel crossover macrohabitat ($\chi^2 = 9.816$; DF = 3; $P = 0.020$). This same trend was evident with otter trawls during the sturgeon season ($\chi^2 = 10.66$; DF = 1; $P = 0.0011$). Nearly all fish were found in bar mesohabitats during the fish community season and channel border mesohabitats during the sturgeon season (Table 33).

The length range of sand shiners collected in 2007 was between 33 to 65 mm for the sturgeon season and 22 to 64 mm during the fish community season (Figure 33). These length ranges were similar to previous years (Hamel and Steffensen 2007). The non-standard push trawl captured an additional 24 sand shiners during the fish community season and displayed a length range of 26 to 54 mm.

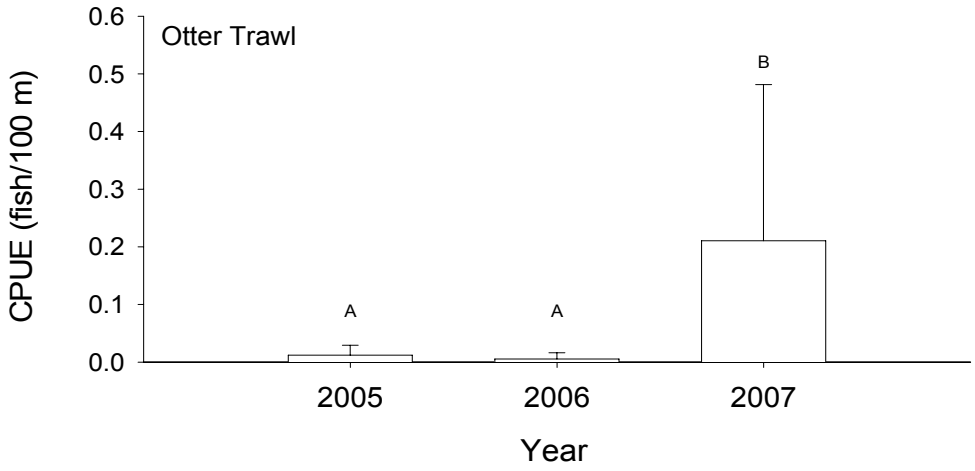

Figure 30. Mean annual catch-per-unit-effort (+/- 2 SE) of sand shiner with otter trawls in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significant differences in mean CPUE between years.

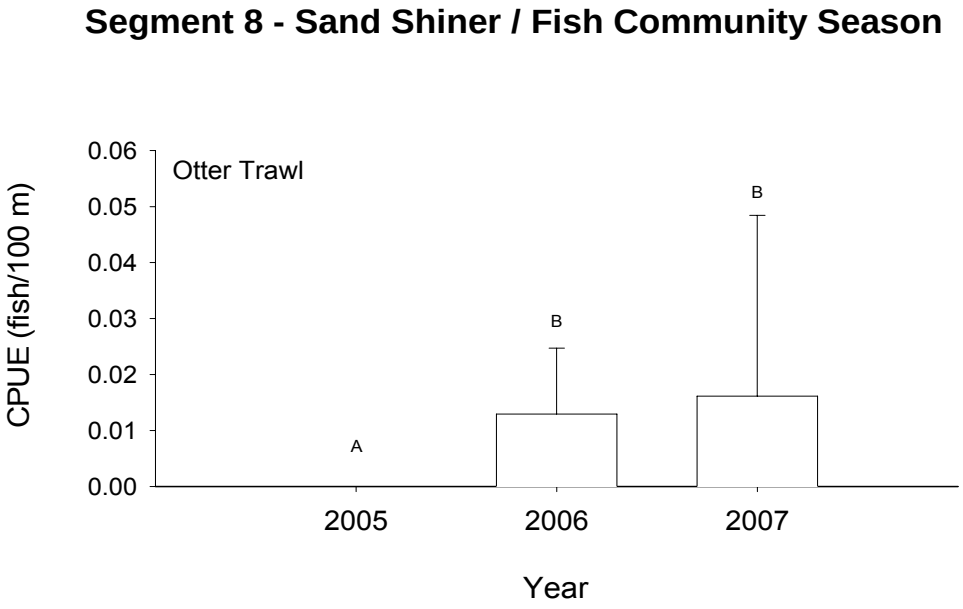

Figure 31. Mean annual catch-per-unit-effort (+/- 2 SE) of sand shiner with otter trawls in Segment 8 of the Missouri River during fish community season 2005-007. Letters denote significant differences in mean CPUE between years.

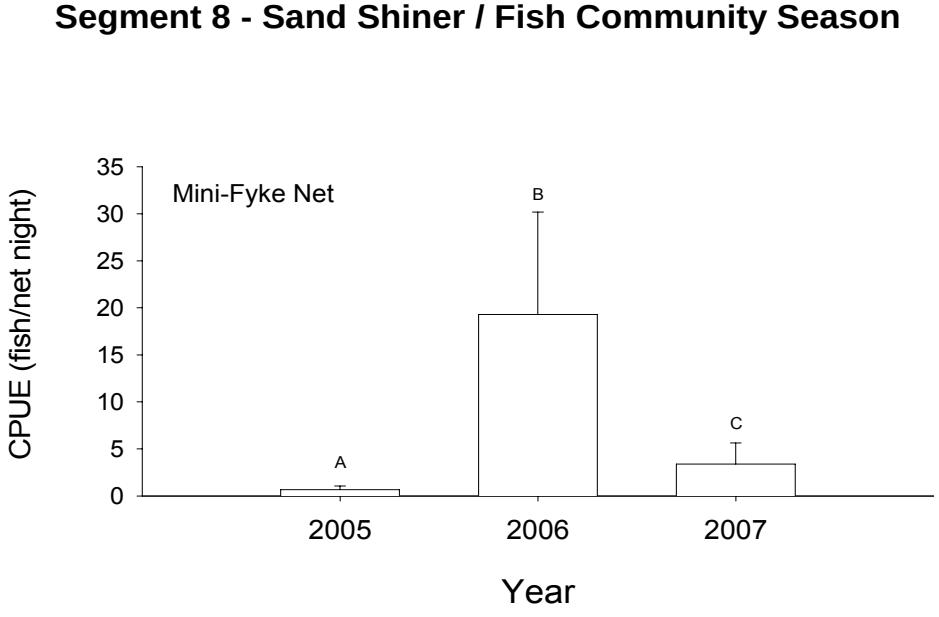

Figure 32. Mean annual catch-per-unit-effort (+/- 2 SE) of sand shiner with mini-fyke nets in Segment 8 of the Missouri River during fish community season 2005-2007. Letters denote significant differences in mean CPUE between years.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	N-E	20	1	N-E	N-E	78		1	N-E	N-E				
Gill Net	0		21				79								
Otter Trawl	27		41 19	1			59 78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	19	1	N-E	N-E	79			N-E	N-E		1	1	
Mini-Fyke Net	406		42 25				58 72						2	2	
Otter Trawl	2		100 19	4			76						1		

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0		100	N-E	N-E		
Gill Net	0		50			50	
Otter Trawl	27		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	0		100	N-E	N-E		
Mini-Fyke Net	406	100 100					
Otter Trawl	2		100 100				

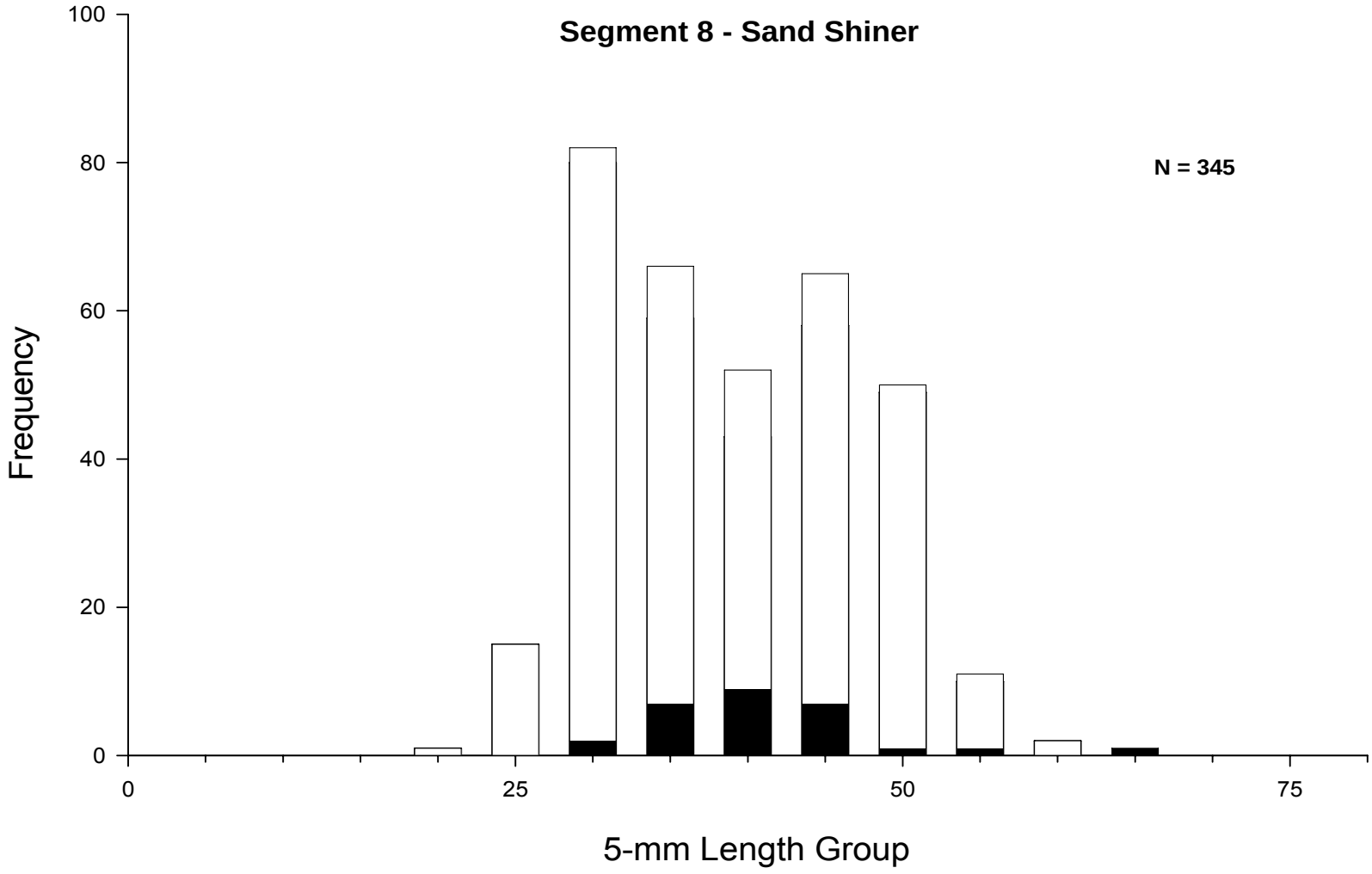

Figure 33. Length frequency of sand shiner during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in Segment 8 of the Missouri River during 2007.

***Hybognathus* spp**.

Only one brassy minnow *H. placitus* was collected in 2007 and was captured in a mini-fyke net during the fish community season. Catch per unit effort for mini-fyke nets was 0.008 fish per net night (Appendix H). The length of the brassy minnow was 45.65 mm. Due to the low number of fish sampled, habitat associations were not made.

Blue Sucker

A total of 1,223 blue suckers were captured in standard trammel nets (N=664), gill nets (N=446), and otter trawls (N=113) during the 2007 sampling season. An additional 12 blue suckers were sampled in the non-standard push trawl (POT02E; N = 2) and in a 2.5" monofilament gill net (GNM25W; N=10) and were not included in this analysis. During the sturgeon season, CPUE was highest for trammel nets (1.48 fish per net night) followed by gill nets (1.19 fish per 100 m drifted) (Figures 38 and 39). In previous years, gill nets have been the most effective gear for collecting blue suckers during the sturgeon season; however, trammel net catch rates have increased every year since 2005 and displayed the highest CPUE in 2007 (χ^2 = 76.46; DF = 2; P = 0.0079; Figure 39). Gill net catch rates were not significantly different between years and continues to be an effective gear for collecting blue suckers during the cold water period (χ^2 = 0.82; DF = 2; P = 0.664). Just as with gill nets, catch rates with otter trawls were not significantly different between 2006 and 2007 (χ^2 = 0.01; DF = 1; P = 0.963).

Trammel nets had the highest CPUE for blue suckers during the fish community season (CPUE = 1.05 fish per 100 m drifted) (Figure 41), which was similar to 2005 and 2006 (χ^2 = 1.61; DF = 2; P = 0.448). Otter trawls displayed similar catch rates to 2006 (χ^2 = 3.62; DF = 1; P = 0.057; Figure 41) and no blue suckers were sampled in mini-fyke nets, which was similar to 2005 (Figure 42).

Blue suckers were most frequently sampled during the sturgeon and fish community season with all gears from inside bend macrohabitats (Table 36). The number of blue suckers that were captured in standard gears were proportionate to the sampling effort within each macrohabitat. Gill nets were the only gear used to sample multiple mesohabitat types and the sampling effort was distributed evenly between channel borders and pools. The proportion of blue suckers sampled in these mesohabitat types was significantly different than where sampling was conducted (χ^2 = 12.22; DF = 1; P = 0.0005). While using gill nets, nearly 75% of blue suckers were sampled in pool mesohabitats even though almost half of the sampling effort was in channel border mesohabitats (Table 37).

The average length for blue suckers collected during the sturgeon and fish community season was 657.9 mm and 632.8 mm, respectively. The length range for blue suckers sampled during the sturgeon season (133 to 851 mm) was significantly larger than the length range during the fish community season (57 to 847 mm) (D = 0.365; P= .0034; Figure 44). Very few small

blue suckers have been captured from 2005 to 2007 (Hamel and Steffensen 2007; Barada and Steffensen 2006).

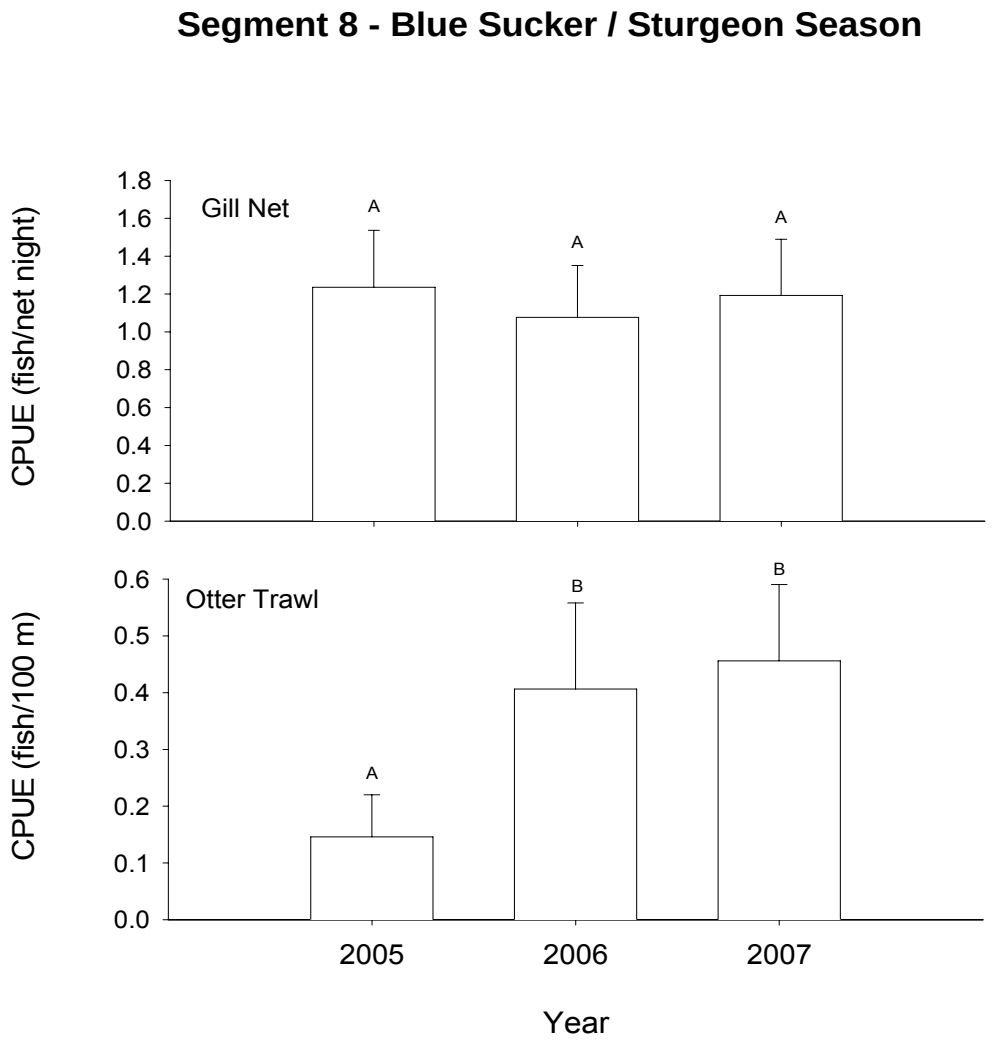

Figure 38. Mean annual catch-per-unit-effort (+/- 2 SE) of blue suckers with gill nets and otter trawls in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significant differences in mean CPUE between years.

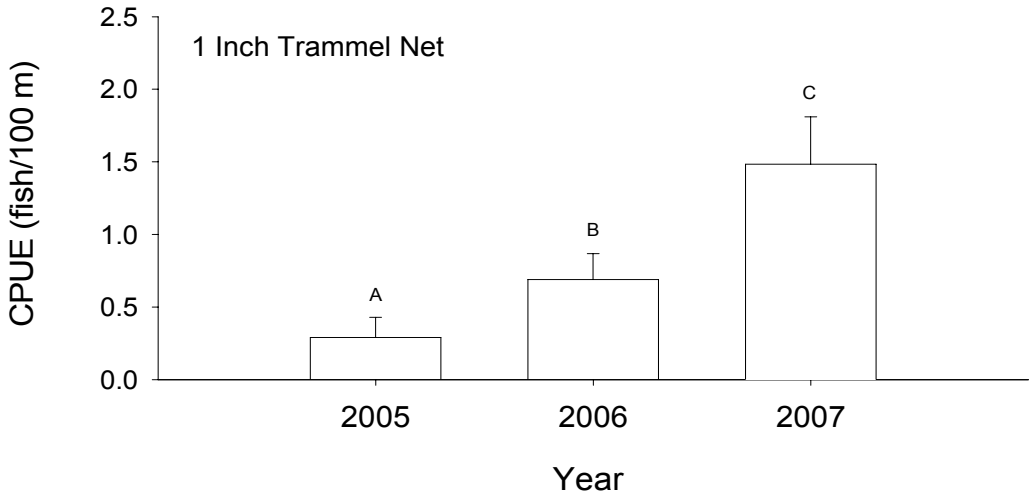

Figure 39. Mean annual catch-per-unit-effort (+/- 2 SE) of blue sucker swith 1-inch trammel nets in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significant differences in mean CPUE between years.

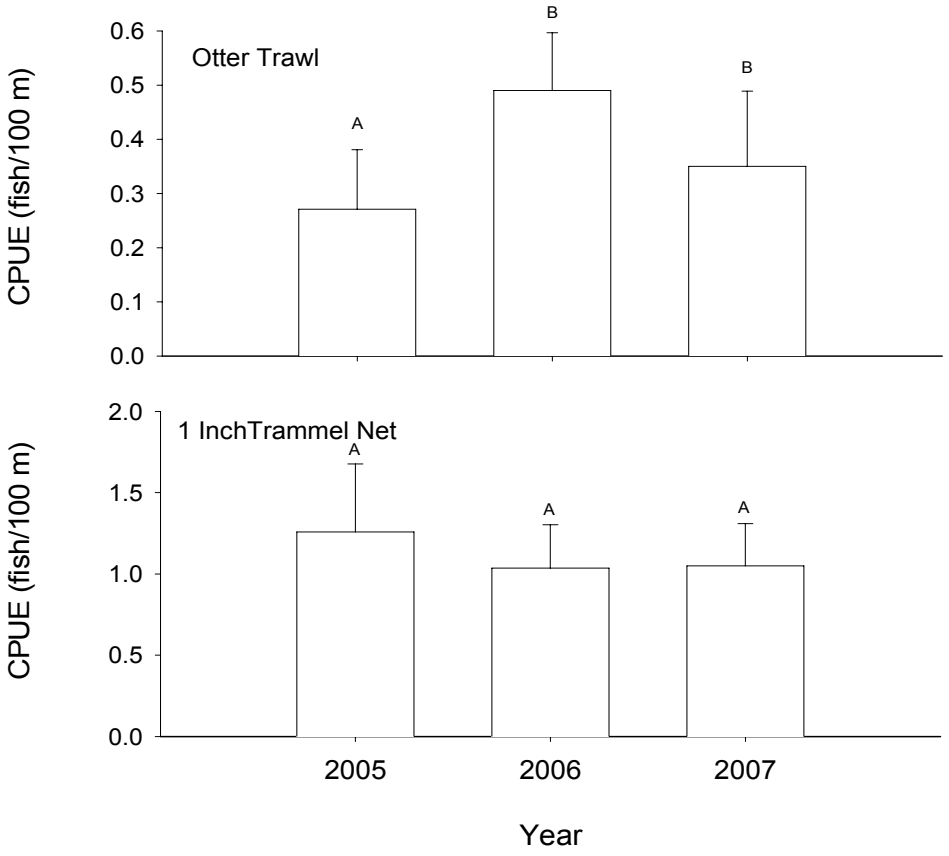

Figure 41. Mean annual catch-per-unit-effort (+/- 2 SE) of blue suckers using otter trawls and 1-inch trammel nets in Segment 8 of the Missouri River during fish community season 2005-2007. Letters denote significant differences in mean CPUE between years.

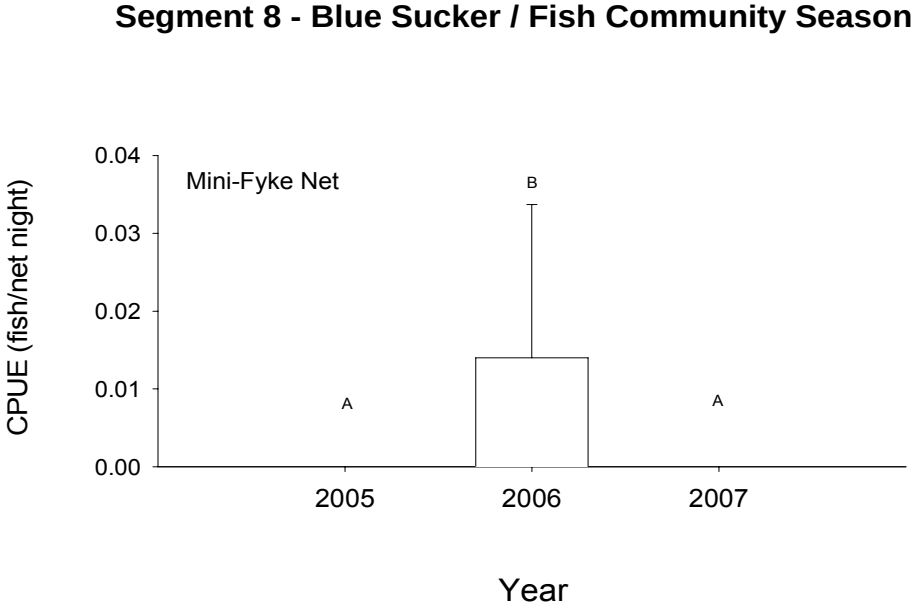

Figure 42. Mean annual catch-per-unit-effort (+/- 2 SE) of blue suckers using mini-fyke nets in Segment 8 of the Missouri River during fish community season 2005-2007. Letters denote significant differences in mean CPUE between years.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	382	N-E	19 20	1	N-E	N-E	81 78		1	N-E	N-E				
Gill Net	446		13 21				87 79								
Otter Trawl	65		27 19	1			73 78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	282	N-E	11 19	1	N-E		89 79			N-E	N-E		1	1	
Mini-Fyke Net	0		25			N-E	72						2	2	
Otter Trawl	49		18 19	4			82 76						1		

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	382		100 100	N-E	N-E		
Gill Net	446		26 50			74 50	
Otter Trawl	64		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	282		100 100	N-E	N-E		
Mini-Fyke Net	0	100					
Otter Trawl	49		100 100				

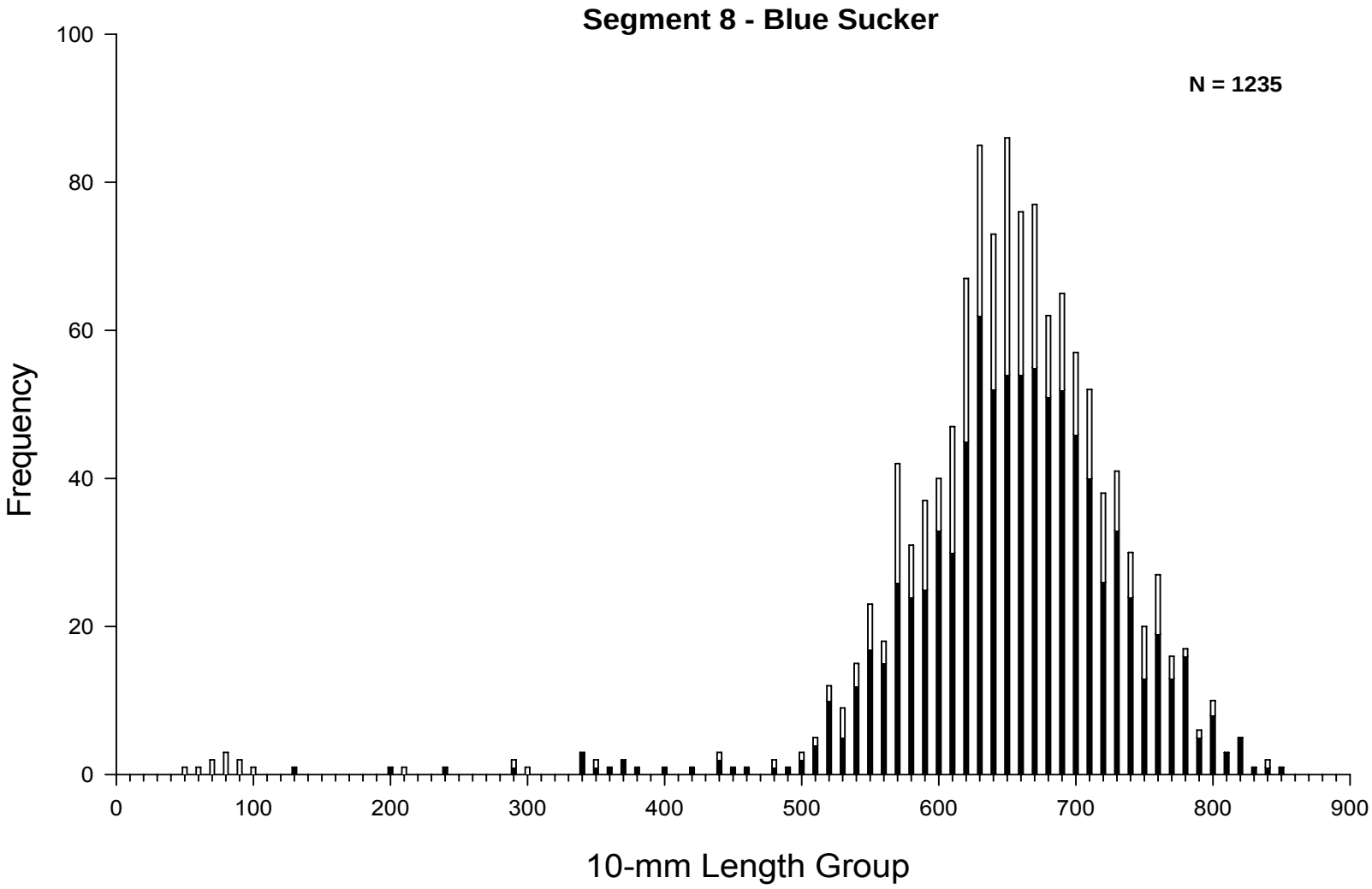

Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in Segment 8 of the Missouri River during 2007.

Sauger

A total of 90 saugers were captured in gill nets (N=51), trammel nets (N=31), otter trawls (N=6), and mini-fyke nets (N=2) during the 2007 sampling season. An additional 3 saugers were sampled with experimental push trawls (POT02E; N=1) and 2.5" monofilament gill nets (GNM25W; N=2) and were not included in this analysis. During the sturgeon season in 2007, CPUE was highest for gill nets (0.136 fish per net night), followed by trammel nets (0.043 fish per 100 m drifted) and otter trawls (0.025 fish per 100 m trawled) (Figures 45 and 46). Catch rates in gill nets and trammel nets were similar to 2006 (χ^2 = 2.18 and 3.19; DF = 1; P = 0.14 and 0.074, respectively.); however, otter trawl catch rates displayed a significant decline compared to 2006 (χ^2 = 25.98; DF = 1; $P < 0.0001$).

During the fish community season in 2007, trammel nets displayed the greatest mean annual CPUE of sauger (0.066 fish per 100 m drifted) followed by mini-fyke nets (CPUE = 0.017 fish per net night) and otter trawls (CPUE = 0.017 fish per 100 m trawled) (Figures 48 and 49). Trammel nets catch rates were significantly higher than 2005 and 2006 (χ^2 = 6.90; DF = 2; P = 0.032); however both otter trawls and mini-fyke nets displayed a significantly lower CPUE compared to 2006 (χ^2 = 15.16, 18.20, respectively; DF = 1; $P < 0.0001$).

Saugers were sampled in greater numbers during the sturgeon season (N=66) than the fish community season (N = 24). During the sturgeon season, all saugers were sampled from inside bend and channel cross-over macrohabitats in direct proportion to where the sampling effort was distributed (χ^2 = 2.94; DF = 1; P = 0.086; Table 38). Gill nets continue to be the most effective gear (N=51) during this sampling season and was the only gear to sample multiple mesohabitats. Within mesohabitats, saugers were captured disproportionately to where sampling efforts were distributed (χ^2 = 29.78; DF = 1; $P < 0.0001$); pool habitats accounted for 86% of all saugers captured with gill nets but only 50% of the effort (Table 39).

Trammel nets accounted for most sauger that were captured during the fish community season (N=20). Nearly all of these fish were captured in the channel border mesohabitat within the inside bend macrohabitat (Table 38). Only four saugers were sampled with mini-fyke nets and otter trawls and were in direct proportion to where the sampling effort took place.

The average length of saugers sampled during the sturgeon and fish community seasons was 441.3 mm and 386.7 mm, respectively. The length range for saugers sampled during the sturgeon season was 224 to 575 mm and 84 to 607 mm for the fish community season (Figure 51). There was a significant difference between the two distributions (D = 0.600; P = 0.0008).

Only two saugers less than 200 mm were sampled in 2007, which was down from 2006 (Hamel and Steffensen 2007). This may indicate differences in reproductive success.

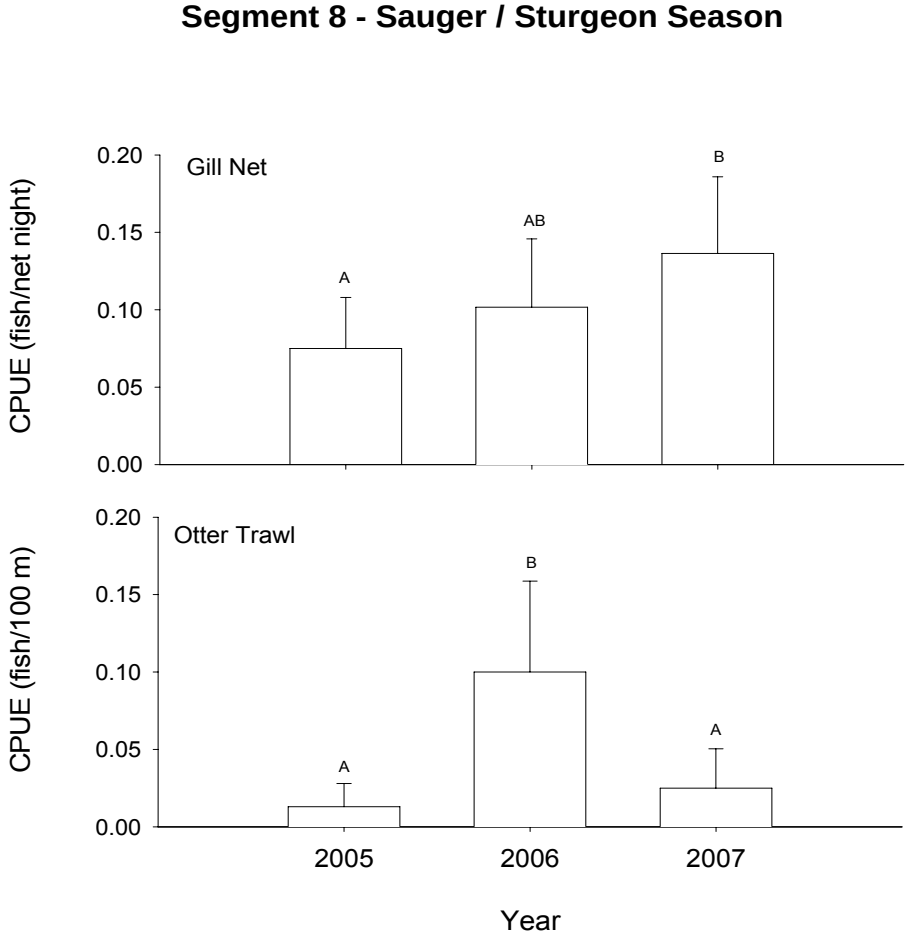

Figure 45. Mean annual catch-per-unit-effort (+/- 2 SE) of saugers using gill nets and otter trawls in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significant differences in mean CPUE between years.

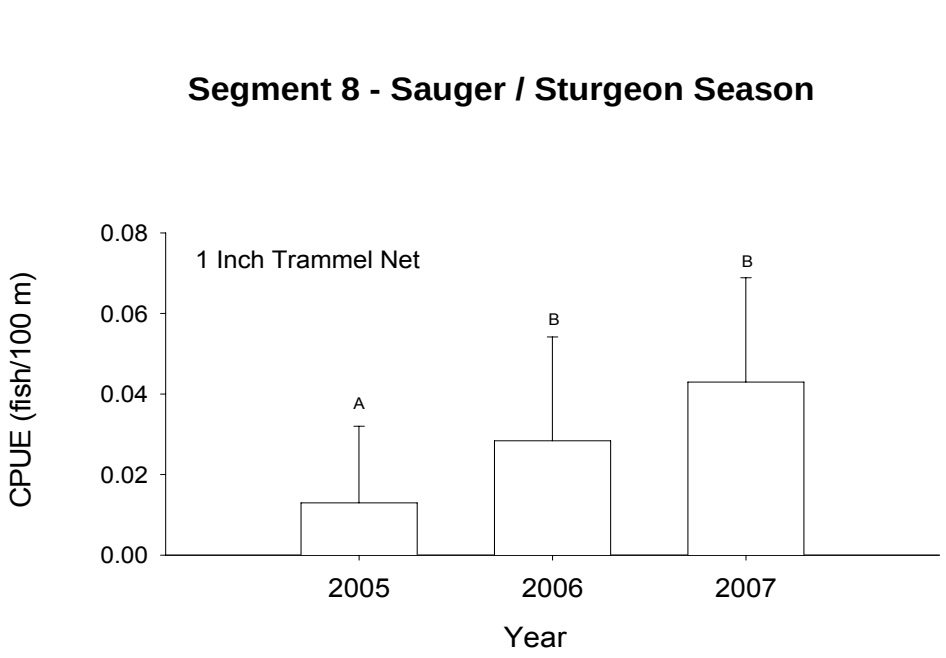

Figure 46. Mean annual catch-per-unit-effort (+/- 2 SE) of saugers using 1-inch trammel nets in Segment 8 of the Missouri River during sturgeon season 2005-2007. Letters denote significant differences in mean CPUE between years.

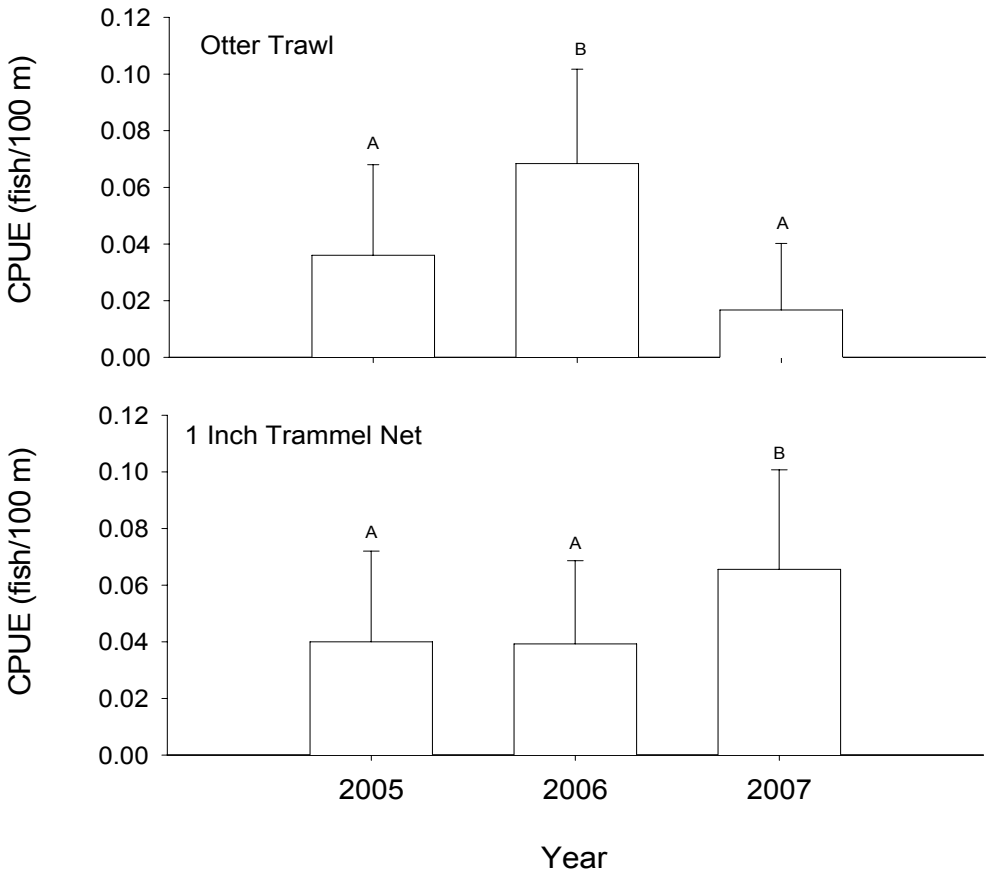

Figure 48. Mean annual catch-per-unit-effort (+/- 2 SE) of saugers using otter trawls and 1-inch trammel nets in Segment 8 of the Missouri River during fish community season 2005-2007.

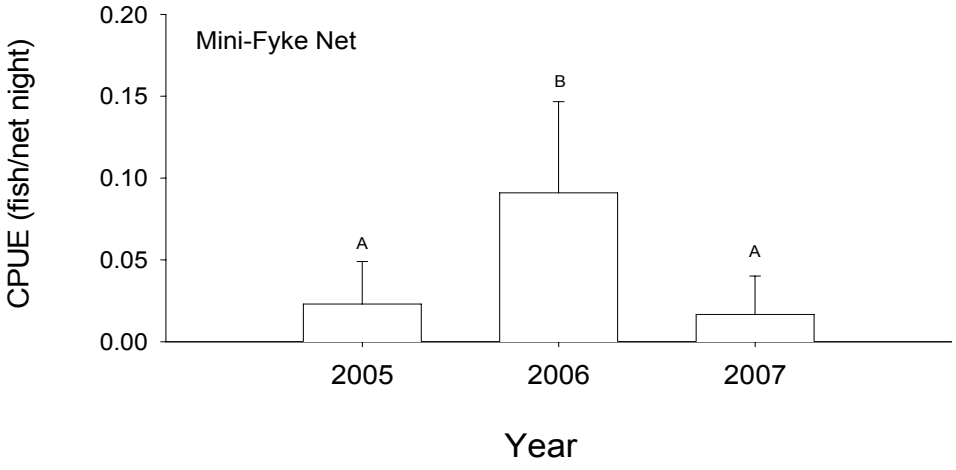

Figure 49. Mean annual catch-per-unit-effort (+/- 2 SE) of saugers using mini-fyke nets in Segment 8 of the Missouri River during fish community season 2005-2007. Letters denote significant differences in mean CPUE between years.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	11	N-E	27 20	1	N-E	N-E	73 78		1	N-E	N-E				
Gill Net	51		12 21				88 79								
Otter Trawl	4		25 19	1			75 78						1		
Fish Community Season (Summer)															
1 Inch Trammel Net	20	N-E	10 19	1	N-E	N-E	90 79			N-E	N-E		1	1	
Mini-Fyke Net	2		25				100 72						2	2	
Otter Trawl	2		100 19	4			76						1		

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 8 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	11		100 100	N-E	N-E		
Gill Net	51		14 50			86 50	
Otter Trawl	4		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	20		100 100	N-E	N-E		
Mini-Fyke Net	2	100 100					
Otter Trawl	2		100 100				

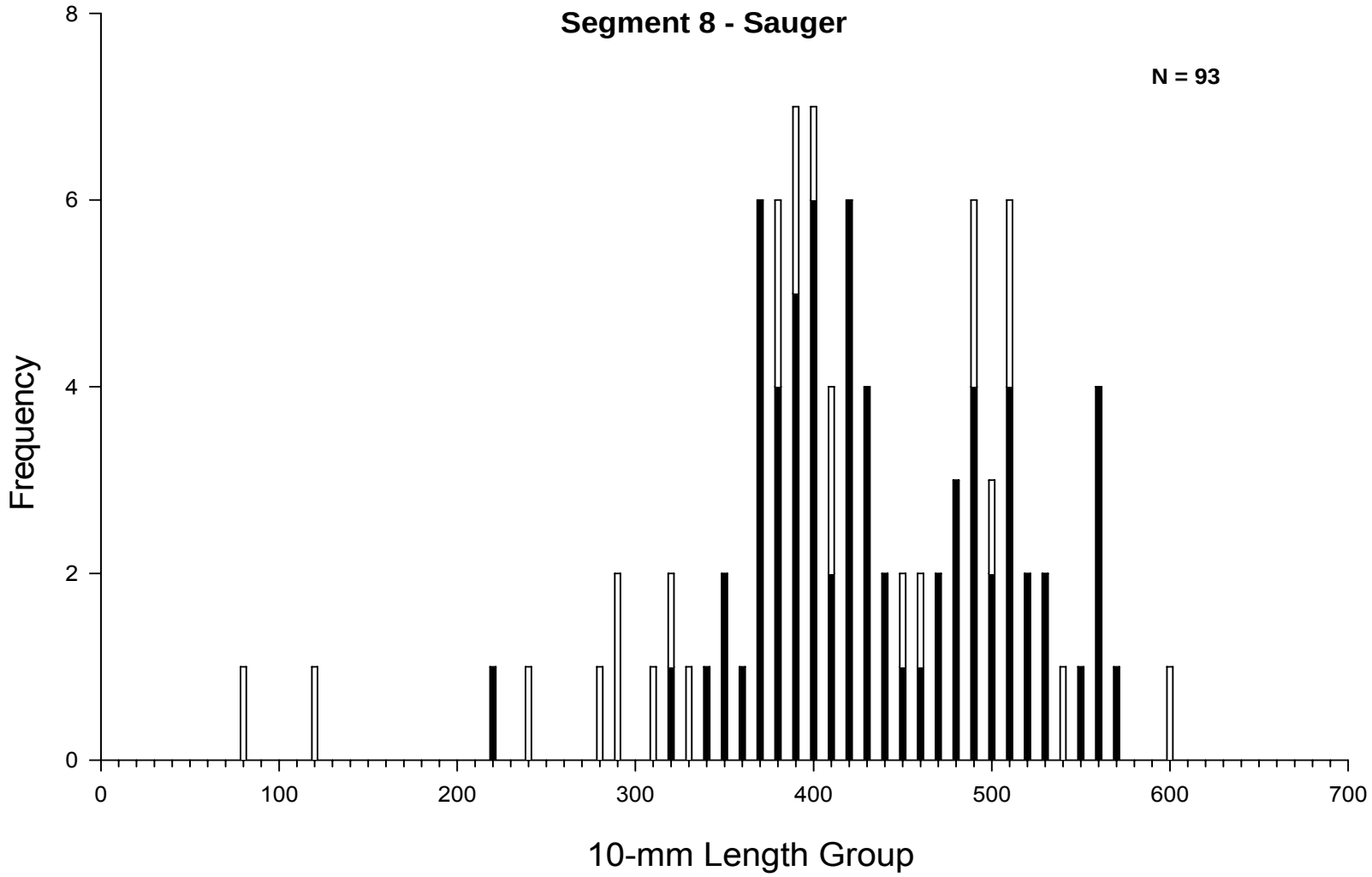

Figure 51. Length frequency of saugers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in Segment 8 of the Missouri River during 2007.

Missouri River Fish Community

A total of 21,512 fish were sampled with standard gears in Segment 8 of the Missouri River in 2007. These gears collected 53 species with red shiners (23.5%; N=5,048), shovelnose sturgeon (13.0%; N=2,807), and channel catfish (10.8%; N=2,320) being the most abundant species collected. Target species accounted for 22.0% of the total catch in 2007. Total numbers of target species collected were: shovelnose sturgeon (N=2,807), blue suckers (N=1,235), sand shiners (N=460), speckled chub (N=93), sauger (N=93), pallid sturgeon (N=34), sicklefin chub (N=4), sturgeon chub (N=3), and *Hybognathus* species (N=1).

Gill nets collected 2,526 fish of 23 different fish species in 2007. Shovelnose sturgeon comprised over half of the entire catch of gill nets (N=1,367; CPUE=3.66) followed by blue suckers (N=446; CPUE=1.19) and goldeye *Hiodon alosoides* (N=284; CPUE=0.76). In past years, gill nets have been the most effective gear for collecting wild and hatchery-reared pallid sturgeon; however, trammel nets and otter trawls captured more pallid sturgeon in Segment 8 during the 2007 sampling seasons.

Trammel nets and otter trawls appear to be effective gears for sampling the fish community in the Missouri River. Both gears continue to catch more fish than previous years; however, effort has also increased each year (Hamel and Steffensen 2007). Otter trawls and trammel nets caught a similar number of species and total fish, yet species composition varied between these two gears, indicating that these gears are complimentary to each other. During the fish community season, the predominant fish species that were sampled with otter trawls were channel catfish *Ictalurus punctatus* (N=1,075; CPUE=7.98), freshwater drum *Aplodinotus grunniens* (N=525; CPUE=3.84), and silver chub (N=427; CPUE=2.97). During the sturgeon season, there were fewer total fish sampled and the predominant fish species were channel catfish (N=547; CPUE=3.22), silver chub (N = 543; CPUE = 3.02), and shovelnose sturgeon (N=81; CPUE=0.48). Higher catch rates and additional species of fish that were sampled during the fish community season most likely resulted from the increase of young-of-the-year fishes. Collectively, otter trawls captured 3,969 total fish in 29,600 m of trawling.

Total catch of fishes in trammel nets increased from previous years; however CPUE was similar for the most abundant species collected. There were a total of 2,617 fish, representing 25 species, captured in 59,000 meters of drifting in 2007. During the sturgeon season, shovelnose sturgeon was the predominant fish species sampled (N=577; CPUE=2.19) followed by blue

suckers (N=385; CPUE=1.48) and goldeye (N=214; CPUE=0.85). These three species were also captured most frequently during the fish community season (Appendix H).

Mini-fyke nets catch the most diverse assortment of fish compared to any other gear. In 2007, a total of 12,400 fish representing 41 species were captured in 153 net nights, resulting in an overall CPUE of 81.0 fish per net night. Red shiners *Cyprinella lutrensis* were the most abundant species of fish sampled with mini-fyke nets (N=4,882; CPUE=40.68). Other prevalent species of fish that were sampled with this gear include: gizzard shad *Dorosoma cepedianum* (N=1,367; CPUE=11.39), river shiner *Notropis blennius* (N=1,221; CPUE=10.18), and smallmouth buffalo (N=1,023; CPUE=8.53). Many young-of-the-year species were sampled in 2007, particularly bluegill *Lepomis macrochirus*, bigmouth buffalo *Ictiobus cyprinellus*, common carp *Cyprinus carpio*, channel catfish, gizzard shad, and smallmouth buffalo *Ictiobus bubalus* (Appendix H). This increase in young-of-the-year species is most likely related to high water events in the early spring that may have triggered spawning events for many of these native species.

An experimental push trawl was implemented as a non-standard gear during the 2007 fish community season. This gear was developed to sample habitat areas that standard gears were unable to effectively sample (i.e., otter trawls and mini-fyke nets). Only one species of fish (i.e., skipjack herring *Alosa chrysochloris*; N=6) was sampled with push trawls but was not sampled with otter trawls or mini-fyke nets. Mini-fyke nets sampled all but three of the same species as push trawls; however, these three species (i.e., blue sucker, skipjack herring, and shovelnose sturgeon) were sampled in very low numbers (i.e., N=2, 6, and 1, respectively). All other species of fish were sampled in much greater abundance with mini-fyke nets, indicating that push trawls may not be an effective gear for sampling habitats that are not currently being sampled with standard gears in Segment 8.

Monofilament gill nets (2.5" bar mesh) were also used as a non-standard gear during the sturgeon season in 2007. These gill nets were utilized to target pallid sturgeon while reducing by-catch of other species. Monofilament gill nets captured 11 different species for a total catch of 156 fish. One pallid sturgeon was sampled with this gear. By-catch was dominated by shovelnose sturgeon (N=133) and blue suckers (N=10) with a few other species being caught in very low numbers. Monofilament gill nets should continue to be evaluated as a gear to collect large pallid sturgeon for the hatchery/stocking program.

Discussion

Pallid Sturgeon

Thirty-four pallid sturgeon were collected during the 2007 sampling season in Segment 8 of the Missouri River (Figure 1b). Hatchery-reared fish made up the majority of the pallid sturgeon sampled (N=30). In previous years, most pallid sturgeon captures occurred during the sturgeon season; however, pallid sturgeon catches were well represented from both seasons in 2007 (Hamel and Steffensen 2006) (Table 7). Pallid sturgeon were captured throughout the length of Segment 8. During the fish community season, seven pallid sturgeon were sampled from Upper Sioux City bend (R.M. 734.7) which is heavily influenced by the Big Sioux River. Other pallid sturgeon captures appeared to be distributed evenly throughout Segment 8 (Figure 1b).

Pallid sturgeon were captured within a variety of macro and mesohabitat types, although the channel border within the inside bend accounted for the most captures (56%) (Table 3). Further analysis indicated that pallid sturgeon were captured in different habitat types (i.e., depth, temperature, velocity, and turbidity) relative to where targeted sampling occurred. However, these differences have not been consistent from year to year, implying that pallid sturgeon capture locations may not be a function of habitat selection (Hamel and Steffensen 2007). Very few macrohabitat types are available on the channelized Missouri River. Within this project, most pallid sturgeon captures have come from the pool or channel border mesohabitat within the inside bend; however, this is where approximately 75% of all sampling occurs. It should be noted that while sampling in the confluence of the Big Sioux River in Upper Sioux City bend (R.M. 734.7), seven hatchery reared pallid sturgeon were captured. Although these captures comprised 86% of all pallid sturgeon catches with otter trawls during the fish community season, only 4% of sampling effort was directed at this habitat type.

Gill nets have been the most effective gear for capturing pallid sturgeon in many segments of the middle and lower Missouri River (Caton et al. 2007; Hamel and Steffensen 2007; Plauck et al. 2007; Shuman et al. 2007; Steffensen and Hamel 2007; Utrup et al. 2007). However, during the 2007 sampling season in Segment 8, trammel nets and otter trawls caught two and three times as many pallid sturgeon as gill nets, respectively. Although trammel nets and otter trawls caught more pallid sturgeon, gill nets had the highest CPUE for wild pallid sturgeon. The sturgeon season continues to be the best season to capture wild pallid sturgeon;

only one wild pallid sturgeon has been collected during the fish community season since sampling began in Segment 8.

An additional 1,785 hatchery reared pallid sturgeon were stocked at Bellevue, NE and Sloan, IA in Segment 8 during 2007 (Appendix E). All fish were from the 2006 year class and six of these fish were recaptured during the spring and summer, indicating that some pallid sturgeon from this stocking event have survived. Survival rates of hatchery reared pallid sturgeon are currently unknown; however, recapture rates of hatchery reared fish will allow researchers to develop survival estimates through mark-recapture procedures. There were an additional 24 hatchery reared pallid sturgeon (2001-2006 year classes) that were recaptured in Segment 8 during 2007. These fish were originally stocked at seven different stocking sites from Standing Bear Bridge near Niobrara, Nebraska (R.M. 845) to Boonville, Missouri (R.M. 195.1), indicating that hatchery reared pallid sturgeon are capable of dispersing great distances after being stocked into the river. Of the 21,623 pallid sturgeon that have been stocked into Segment 8, only 56 have been recovered. This low recapture rate demonstrates the need to understand survival, dispersal, and habitat selection of hatchery-raised pallid sturgeon to accurately determine the true number of hatchery reared and wild pallid sturgeon that are currently in the system.

Shovelnose Sturgeon

Gill nets were the most effective gear for collecting shovelnose sturgeon (N=1,367) and captured 51% of all shovelnose sturgeon. Trammel nets (N=1,153) contributed notably more shovelnose sturgeon than 2006 and was the most effective gear for collecting shovelnose sturgeon during the fish community season. No standard gear was very effective at catching sub-stock (0-149 mm and 150-249 mm) or stock size (250-379 mm) shovelnose sturgeon. Gill nets had the highest CPUE for quality and above size shovelnose sturgeon followed by trammel nets.

Shovelnose sturgeon were sampled in similar proportions to the amount of sampling effort directed toward each macrohabitat type (Tables 17–24). Gill nets were the only gear used to sample more than one mesohabitat. Similar to pallid sturgeon, shovelnose sturgeon were found in greater quantities in pools compared to channel borders. Very few sub-stock (0-149 mm and 150-249 mm) and stock size (250-379 mm) shovelnose sturgeon have been collected in Segment 8, implying that recruitment of shovelnose sturgeon may not be occurring very often. However, length frequency distributions of shovelnose sturgeon from 2005-2007 indicate that comparable numbers of adult size (i.e., 450-650 mm) fish were found each year (Hamel and Steffensen 2007; Barada and Steffensen 2006) (Figure 17). Similar trends in length frequency

distributions of shovelnose sturgeon have been observed in other segments of the Missouri River, indicating that recruitment of shovelnose sturgeon is probably occurring on an annual basis, although year class strength is unknown (Caton et al. 2007; Plauck et al. 2007; Steffensen and Hamel 2007; Utrup et al. 2007; Steffensen and Barada 2006). It is unclear why catch rates remain low for juvenile size (<450 mm) shovelnose sturgeon. Gears that target small fish may be inefficient or difficult to use due to the variable flows, snags, and lack of habitat in Segment 8 on the Missouri River. In addition, small shovelnose sturgeon may be selecting habitat that is currently not sampled by the population assessment team.

Macrophybopsis spp.

Otter trawling was the most successful standard sampling method for all *Macrophybopis* spp. Otter trawling collected all sturgeon chub (N=3), sicklefin chub (N=1) and 78 of 80 speckled chub throughout both seasons. Mini-fyke nets were the only other standard gear to collect M*acrophybopis* spp. (i.e., two speckled chub). The non-standard push trawl captured thirteen speckled chub and three sicklefin chub. Very few *Macrophybopis* spp. have been collected since 2005. Although it is very difficult to make accurate comparisons between years due to low sample sizes, it appears that *Macrophybopis* spp. are declining through time (Hamel and Steffensen 2007; Barada and Steffensen 2006).

Hybognathus spp.

Only one *Hybognathus* spp. (Brassy minnow) was collected in 2007. Similar to *Macrophybopis* spp., *Hybognathus* spp. have been sampled in very low numbers since sampling began in 2005 and appear to be declining through time. Mini-fyke nets have been the only gear that has collected fish during all years. Due to low sample size, little is known about *Hybognathus* spp. in Segment 8. Currently, the population seems to be very low compared to catches in other channelized segments in previous years (Plauck et al. 2007; Steffensen and Hamel 2007; Utrup et al. 2007).

Sand Shiner

Mini-fyke nets continue to be the most effective gear for collecting sand shiners in Segment 8, collecting 406 of 435 total fish. Otter trawls were the only other gear to collect sand shiners during the sturgeon season; however, sample size was low (N=27). The total number of sand shiners collected in 2007 was only about half as many that were collected in 2006 (N=881);

however, the numbers in 2007 were nearly double those from 2005 (N=252) (Barada and Steffensen 2006).

Blue Sucker

Trammel nets and gill nets were the most effective sampling gears, collecting nearly 91% of blue suckers during 2007 (Figures 38 and 39). Blue suckers were caught throughout both seasons and the percentage of fish caught with all gears was proportionate to the area that was sampled (Tables 36 and 37). During the sturgeon season, gill nets caught the majority of blue suckers in pool mesohabitats. Similar to shovelnose sturgeon, very few small blue suckers were captured since sampling began in 2005.

Sauger

Gill and trammel nets were the most effective gears for collecting saugers in 2007 and captured approximately 91% of all fish (Figures 45 and 46). In previous years, otter trawls were one of the most effective gears for collecting saugers; however, very few were captured with this gear in 2007 (N=6). Trammel nets had the highest catch rates (CPUE=0.07) during the fish community season. Mini-fyke nets and otter trawls had the same catch rates (CPUE=0.02) which was significantly lower than previous years. Saugers were typically found in the same macrohabitat types where most of the sampling occured; however, when using gill nets, more saugers were found in deeper pools than in the channel border mesohabitat.

Miscellaneous Work

Beside the completion of the required contractual work, the Nebraska Game and Parks Commission Pallid Sturgeon Assessment (PSA) Crew also participated in several side projects, conferences and training courses.

- January 18, 19, and 20 – Attended the Nebraska Chapter of the American Fisheries Society's annual meeting in Council Bluffs.

- March 6, 7, and 8 – Attended the Missouri River Natural Resource Conference / Biological Opinion Forum in Nebraska City.

- May 8 and 9 – Assisted in tagging and stocking pallid sturgeon at Gavins Point National Fish Hatchery.

- May 14, 15, and 16 – Attended the annual project training at the Desoto National Wildlife Refuge.

- June 7 – Assisted Matt Schwarz with the U.S. Fish and Wildlife Service (Grand Island Office) with collecting shovelnose sturgeon in Boyer Chute for a contaminants study.

- September 22 and 23 – Hosted Missouri River boat tours at the annual Ponca Outdoor Expo.

- October 7 - Collected Asian carp genetic samples for a DNA study for Dr. Guoqing Lu at the University of Nebraska-Omaha.

- October 15, 16, and 17 – Hosted the Nebraska Game and Parks Commission Fisheries Division Meeting at Aksarben Aquarium in Gretna, NE.

- October 18 – Assisted the Neosho National Fish Hatchery staff stocking pallid sturgeon at Bellevue, NE.

- December 5, 6, 7, and 8 – Attended the Midwest Fish and Wildlife Conference in Madison, WI

- The PSA crew participated in the development and gear evaluation of an experimental push trawl. The push trawl was tested as an alternative gear to collect additional information on small bodied fishes, especially in habitats were mini-fyke nets are ineffective due to current or depth and areas were otter trawls are ineffective due to shallow water. The results of the evaluation of the experimental push trawl are pending.

- Assistance was provided to Ben Neely, a graduate student at the University of Nebraska in Lincoln. Mr. Neely is doing a telemetry study on blue suckers in the Missouri River. Fish were collected and implanted with telemetry tags for Mr. Neely's graduate project.

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APPENDICES

Appendix A. Phylogenetic list of Missouri River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. The phylogeny follows that used by the American Fisheries Society, Common and Scientific Names of Fishes from the United States and Canada, 5th edition. Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
	CLASS CEPHALASPIDOMORPHI-LAMPREYS	
	ORDER PETROMYZONTIFORMES	
	Petromyzontidae – lampreys	
Ichthyomyzon castaneus	Chestnut lamprey	CNLP
Ichthyomyzon fossor	Northern brook lamprey	NBLP
Ichthyomyzon unicuspis	Silver lamprey	SVLP
Ichthyomyzon gagei	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLP
	CLASS OSTEICHTHYES – BONY FISHES	
	ORDER ACIPENSERIFORMES	
	Ascipenseridae – sturgeons	
Acipenser fulvescens	Lake sturgeon	LKSG
Scaphirhynchus spp.	Unidentified Scaphirhynchus	USG
Scaphirhynchus albus	**Pallid sturgeon**	**PDSG***
Scaphirhynchus platorynchus	**Shovelnose sturgeon**	**SNSG***
S. albus X S. platorynchus	Pallid-shovelnose hybrid	SNPD
	Polyodontidae – paddlefishes	
Polyodon spathula	Paddlefish	PDFH
	ORDER LEPISOSTEIFORMES	
	Lepisosteidae – gars	
Lepisosteus oculatus	Spotted gar	STGR
Lepisosteus osseus	Longnose gar	LNGR
Lepisosteus platostomus	Shortnose gar	SNGR
	ORDER AMMIFORMES	
	Amiidae – bowfins	
Amia calva	Bowfin	BWFN
	ORDER OSTEOGLOSSIFORMES	
	Hiodontidae – mooneyes	
Hiodon alosoides	Goldeye	GDEY
Hiodon tergisus	Mooneye	MNEY
	ORDER ANGUILLIFORMES	
	Anguillidae – freshwater eels	
Anguilla rostrata	American eel	AMEL

Appendix A. (continued).

Scientific name	Common name	Lettter Code
	ORDER CLUPEIFORMES	
	Clupeidae – herrings	
Alosa alabame	Alabama shad	ALSD
Alosa chrysochloris	Skipjack herring	SJHR
Alosa pseudoharengus	Alewife	ALWF
Dorosoma cepedianum	Gizzard shad	GZSD
Dorosoma petenense	Threadfin shad	TFSD
D. cepedianum X D. petenense	Gizzard-threadfin shad hybrid	GSTS
	ORDER CYPRINIFORMES	
	Cyprinidae – carps and minnows	
Campostoma anomalum	Central stoneroller	CLSR
Campostoma oligolepis	Largescale stoneroller	LSSR
Carassus auratus	Goldfish	GDFH
Carassus auratus X Cyprinius carpio	Goldfish-Common carp hybrid	GFCC
Couesis plumbens	Lake chub	LKCB
Ctenopharyngodon idella	Grass carp	GSCP
Cyprinella lutrensis	Red shiner	RDSN
Cyprinella spiloptera	Spotfin shiner	SFSN
Cyprinus carpio	Common carp	CARP
Erimystax x-punctatus	Gravel chub	GVCB
Hybognathus argyritis	**Western slivery minnow**	**WSMN***
Hybognathus hankinsoni	Brassy minnow	BSMN
Hybognathus nuchalis	Mississippi silvery minnow	SVMW
Hybognathus placitus	**Plains minnow**	**PNMW***
***Hybognathus* spp.**	**Unidentified Hybognathus**	**HBNS***
Hypophthalmichthys molitrix	Silver carp	SVCP
Hypophthalmichthys nobilis	Bighead carp	BHCP
Luxilus chrysocephalus	Striped shiner	SPSN
Luxilus cornutus	Common shiner	CMSN
Luxilus zonatus	Bleeding shiner	BDSN
Lythrurus unbratilis	Western redfin shiner	WRFS
Macrhybopsis aestivalis	**Speckled chub**	**SKCB***
Macrhybopsis gelida	**Sturgeon chub**	**SGCB***
Macrhybopsis meeki	**Sicklefin chub**	**SFCB***
Macrhybopsis storeriana	Silver chub	SVCB
M. aestivalis X M. gelida	Speckled-Sturgeon chub hybrid	SPST
M. gelida X M. meeki	Sturgeon-Sicklefin chub hybrid	SCSC
Macrhybopsis spp.	Unidentified chub	UHY
Margariscus margarita	Pearl dace	PLDC
Mylocheilus caurinus	Peamouth	PEMT
Nocomis biguttatus	Hornyhead chub	HHCB
Notemigonus crysoleucas	Golden shiner	GDSN
Notropis atherinoides	Emerald shiner	ERSN
Notropis blennius	River shiner	RVSN
Notropis boops	Bigeye shiner	BESN
Notropis buchanani	Ghost shiner	GTSN
Notropis dorsalis	Bigmouth shiner	BMSN
Notropis greenei	Wedgespot shiner	WSSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
	Cyprinidae – carps and minnows	
Notropis heterolepsis	Blacknose shiner	BNSN
Notropis hudsonius	Spottail shiner	STSN
Notropis nubilus	Ozark minnow	OZMW
Notropis rubellus	Rosyface shiner	RYSN
Notropis shumardi	Silverband shiner	SBSN
Notropis stilbius	Silverstripe shiner	SSPS
Notropis stramineus	**Sand shiner**	**SNSN***
Notropis topeka	Topeka shiner	TPSN
Notropis volucellus	Mimic shiner	MMSN
Notropis wickliffi	Channel shiner	CNSN
Notropis spp.	Unidentified shiner	UNO
Opsopoeodus emiliae	Pugnose minnow	PNMW
Phenacobius mirabilis	Suckermouth minnow	SMMW
Phoxinus eos	Northern redbelly dace	NRBD
Phoxinus erythrogaster	Southern redbelly dace	SRBD
Phoxinus neogaeus	Finescale dace	FSDC
Pimephales notatus	Bluntnose minnow	BNMW
Pimephales promelas	Fathead minnow	FHMW
Pimephales vigilas	Bullhead minnow	BHMW
Platygobio gracilis	Flathead chub	FHCB
P. gracilis X M. meeki	Flathead-sicklefin chub hybrid	FCSC
Rhinichthys atratulus	Blacknose dace	BNDC
Rhinichthys cataractae	Longnose dace	LNDC
Richardsonius balteatus	Redside shiner	RDSS
Scardinius erythrophtalmus	Rudd	RUDD
Semotilus atromaculatus	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
	Unidentified Asian Carp	UAC
	Catostomidae - suckers	
Carpiodes carpio	River carpsucker	RVCS
Carpiodes cyprinus	Quillback	QLBK
Carpiodes velifer	Highfin carpsucker	HFCS
Carpiodes spp.	Unidentified Carpiodes	UCS
Catostomus catostomus	Longnose sucker	LNSK
Catostomus commersoni	White sucker	WTSK
Catostomus platyrhyncus	Mountain sucker	MTSK
Catastomus spp.	Unidentified *Catastomus* spp.	UCA
Cycleptus elongates	**Blue sucker**	**BUSK***
Hypentelium nigricans	Northern hog sucker	NHSK
Ictiobus bubalus	Smallmouth buffalo	SMBF
Ictiobus cyprinellus	Bigmouth buffalo	BMBF
Ictiobus niger	Black buffalo	BKBF
Ictiobus spp.	Unidentified buffalo	UBF
Minytrema melanops	Spotted sucker	SPSK
Moxostoma anisurum	Silver redhorse	SVRH
Moxostoma carinatum	River redhorse	RVRH
Moxostoma duquesnei	Black redhorse	BKRH
Moxostoma erythrurum	Golden redhorse	GDRH
Moxostoma macrolepidotum	Shorthead redhorse	SHRH
Moxostoma spp.	Unidentified redhorse	URH

Appendix A. (continued).

Scientific name	Common name	Letter Code
Catostomidae - suckers	Unidentified Catostomidae	UCT
	ORDER SILURIFORMES	
	Ictaluridae – bullhead catfishes	
Ameiurus melas	Black bullhead	BKBH
Ameiurus natalis	Yellow bullhead	YLBH
Ameiurusnebulosus	Brown bullhead	BRBH
Ameiurus spp.	Unidentified bullhead	UBH
Ictalurus furcatus	Blue catfish	BLCF
Ictalurus punctatus	Channel catfish	CNCF
I. furcatus X I. punctatus	Blue-channel catfish hybrid	BCCC
Ictalurus spp.	Unidentified *Ictalurus* spp.	UCF
Noturus exilis	Slender madtom	SDMT
Noturus flavus	Stonecat	STCT
Noturus gyrinus	Tadpole madtom	TPMT
Noturus nocturnes	Freckled madtom	FKMT
Pylodictis olivaris	Flathead catfish	FHCF
	ORDER SALMONIFORMES	
	Esocidae - pikes	
Esox americanus vermiculatus	Grass pickerel	GSPK
Esox lucius	Northern pike	NTPK
Esox masquinongy	Muskellunge	MSKG
E. lucius X E. masquinongy	Tiger Muskellunge	TGMG
	Umbridae - mudminnows	
Umbra limi	Central mudminnow	MDMN
	Osmeridae - smelts	
Osmerus mordax	Rainbow smelt	RBST
	Salmonidae - trouts	
Coregonus artedi	Lake herring or cisco	CSCO
Coregonus clupeaformis	Lake whitefish	LKWF
Oncorhynchus aguabonita	Golden trout	GDTT
Oncorhynchus clarki	Cutthroat trout	CTTT
Oncorhynchus kisutch	Coho salmon	CHSM
Oncorhynchus mykiss	Rainbow trout	RBTT
Oncorhynchus nerka	Sockeye salmon	SESM
Oncorhynchus tshawytscha	Chinook salmon	CNSM
Prosopium cylindraceum	Bonniville cisco	BVSC
Prosopium williamsoni	Mountain whitefish	MTWF
Salmo trutta	Brown trout	BNTT
Salvelinus fontinalis	Brook trout	BKTT
Salvelinus namaycush	Lake trout	LKTT
Thymallus arcticus	Arctic grayling	AMGL

Appendix A. (continued).

Scientific name	Common name	Letter Code
	ORDER PERCOPSIFORMES	
	Percopsidae – trout-perches	
Percopsis omiscomaycus	Trout-perch	TTPH
	ORDER GADIFORMES	
	Gadidae - cods	
Lota lota	Burbot	BRBT
	ORDER ATHERINIFORMES	
	Cyprinodontidae - killifishes	
Fundulus catenatus	Northern studfish	NTSF
Fundulus daphanus	Banded killifish	BDKF
Fundulus notatus	Blackstripe topminnow	BSTM
Fundulus olivaceus	Blackspotted topminnow	BPTM
Fundulus sciadicus	Plains topminnow	PTMW
Fundulus zebrinus	Plains killifish	PKLF
	Poeciliidae - livebearers	
Gambusia affinis	Western mosquitofish	MQTF
	Atherinidae - silversides	
Labidesthes sicculus	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	Gasterosteidae - sticklebacks	
Culea inconstans	Brook stickleback	BKSB
	ORDER SCORPAENIFORMES	
	Cottidae - sculpins	
Cottus bairdi	Mottled sculpin	MDSP
Cottus carolinae	Banded sculpin	BDSP
	ORDER PERCIFORMES	
	Percichthyidae – temperate basses	
Morone Americana	White perch	WTPH
Morone chrysops	White bass	WTBS
Morone mississippiensis	Yellow bass	YWBS
Morone saxatilis	Striped bass	SDBS
M. saxatilis X M. chrysops	Striped-white bass hybrid	SBWB
	Centrarchidae - sunfishes	
Ambloplites rupestris	Rock bass	RKBS
Archoplites interruptus	Sacremento perch	SOPH
Lepomis cyanellus	Green sunfish	GNSF
Lepomis gibbosus	Pumpkinseed	PNSD
Lepomis gulosus	Warmouth	WRMH
Lepomis humilis	Orangespotted sunfish	OSSF
Lepomis macrochirus	Bluegill	BLGL
Lepomis magalotis	Longear sunfish	LESF
Lepomis microlophus	Redear sunfish	RESF
L. cyanellus X L. macrochirus	Green sunfish-bluegill hybrid	GSBG

Appendix A. (continued).

Scientific name	Common name	Letter Code
	Centrarchidae - sunfishes	
L. cyanellus X L. humilis	Green-orangespotted sunfish hybrid	GSOS
L. macrochirus X L. microlophus	Bluegill-redear sunfish hybrid	BGRE
Lepomis spp.	Unidentified *Lepomis*	ULP
Micropterus dolomieu	Smallmouth bass	SMBS
Micropterus punctatus	Spotted sunfish	STBS
Micropterus salmoides	Largemouth bass	LMBS
Micropterus spp.	Unidentified *Micropterus* spp.	UMC
Pomoxis annularis	White crappie	WTCP
Pomoxis nigromaculatus	Black crappie	BKCP
Pomoxis spp.	Unidentified crappie	UCP
P. annularis X P. nigromaculatus	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified centrarchid	UCN
	Percidae - perches	
Ammocrypta asprella	Crystal darter	CLDR
Etheostoma blennioides	Greenside darter	GSDR
Etheostoma caeruleum	Rainbow darter	RBDR
Etheostoma exile	Iowa darter	IODR
Etheostoma flabellare	Fantail darter	FTDR
Etheostoma gracile	Slough darter	SLDR
Etheostoma microperca	Least darter	LTDR
Etheostoma nigrum	Johnny darter	JYDR
Etheostoma punctulatum	Stippled darter	STPD
Etheostoma spectabile	Orangethroated darter	OTDR
Etheostoma tetrazonum	Missouri saddled darter	MSDR
Etheostoma zonale	Banded darter	BDDR
Etheostoma spp.	Unidentified Etheostoma spp.	UET
Perca flavescens	Yellow perch	YWPH
Percina caproides	Logperch	LGPH
Percina cymatotaenia	Bluestripe darter	BTDR
Percina evides	Gilt darter	GLDR
Percina maculate	Blackside darter	BSDR
Percina phoxocephala	Slenderhead darter	SHDR
Percina shumardi	River darter	RRDR
Percina spp.	Unidentified Percina spp.	UPN
	Unidentified darter	UDR
Sander canadense	**Sauger**	**SGER***
Sander vitreus	Walleye	WLEY
S. canadense X S. vitreus	Sauger-walley hybrid/Saugeye	SGWE
Sander spp.	Unidentified *Sander* (formerly *Stizostedion*) spp.	UST
	Unidentified Percidae	UPC
	Sciaenidae - drums	
Aplodinotus grunniens	Freshwater drum	FWDM
	NON-TAXONOMIC CATEGORIES	
	Age-0/Young-of-year fish	YOYF
	Lab fish for identification	LAB
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF

Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term pallid sturgeon and associated fish community sampling program. Three habitat scales were used in the hierarchical habitat classification system: Macrohabitats, Mesohabitats, and Microhabitats.

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendric	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m^3/s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m^3/s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Dam Tailwaters	Meso	Area below dam	DTWT
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in Segment 8 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2005 for Segment 8.

Gear	Code	Type	Season	Years	CPUE units
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	fish/net night
Trammel net – 1 inch inner mesh	TN	Standard	All	2003 - Present	fish/100 m drift
Otter trawl – 16 ft head rope	OT16	Standard	All	2003 - Present	fish/100 m trawled
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night
Beam trawl	BT	Standard	All	2003 - 2004	fish/100 m trawled
Hoop net – 4 ft.	HN	Standard	All	2003 - 2004	fish/net night
Trammel net – 2.5 inch inner mesh	TN25	Standard	Sturgeon	2005 - 2006	fish/100 m drift
Bag Seine – quarter arc method pulled upstream	BSQU	Standard	Fish Comm.	2003 - 2005	fish/100 m^2
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - 2005	fish/100 m^2
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - 2005	fish/100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - 2005	fish/100 m^2
Bag Seine – rectangular method upstream	BSRU	Standard	Fish Comm.	2003 - 2005	fish/100 m^2
Bag Seine – rectangular method downstream	BSRD	Standard	Fish Comm.	2003 - 2005	fish/100 m^2
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Evaluation	Fish Comm.	2006 - Present	fish/100 m trawled
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2006 - Present	fish/ m trawled

Appendix D. Stocking locations and codes by Recovery Priority Management Area (RPMA) in the Missouri River Basin.

State(s)	RPMA	Site Name	Code	River	RM
MT	2	Forsyth	FOR	Yellowstone	253.2
MT	2	Cartersville	CAR	Yellowstone	235.3
MT	2	Miles City	MIC	Yellowstone	181.8
MT	2	Fallon	FAL	Yellowstone	124.0
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Grand Champs	GRC	Missouri	1741.0
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709.0
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
NE/MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KA/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 8 of the Missouri River (RPMA 4).

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2002	Bellevue	579	2001	4/3/2002	Yearling	Pit Tag	
2002	Bellevue	1530	2001	4/11/2002	Yearling	Pit Tag	
2002	Bellevue	298	2001	11/1/2002	Yearling	Pit Tag	Elastomer
2002	Bellevue	187	1999	11/1/2002	3 yo	Pit Tag	
2003	Bellevue	1938	2002	7/16/2003	Yearling	Pit Tag	
2003	Bellevue	500	2002	9/4/2003	Yearling	Pit Tag	Elastomer
2003	Bellevue	717	2002	10/30/2003	Yearling	Pit Tag	Elastomer
2003	Bellevue	1770	2003	12/2/2003	Fingerling	Elastomer	CWT
2004	Bellevue	56	2003	7/8/2004	Yearling	Elastomer	CWT
2004	Bellevue	762	2003	7/8/2004	Yearling	Pit Tag	Elastomer
2004	Bellevue	416	2003	7/30/2004	Yearling	Pit Tag	Elastomer
2004	Boyer Chute	51	2003	8/2/2004	Yearling	Pit Tag	Elastomer
2004	Bellevue	6634	2004	9/10/2004	Fingerling	Elastomer	CWT
2005	Sioux City	2004	2004	4/22/2005	Yearling	Pit Tag	Elastomer
2005	Sioux City	554	2004	4/22/2005	Yearling	Elastomer	CWT
2006	Bellevue	628	2005	5/5/2006	Yearling	Pit Tag	Elastomer
2006	Bellevue	607	2005	8/31/2006	Yearling	Pit Tag	Elastomer
2006	Decatur	607	2005	9/1/2006	Yearling	Pit Tag	Elastomer
2007	Sloan	923	2006	5/10/2007	Yearling	Elastomer	Scute Removal
2007	Bellevue	862	2006	5/9/2007	Yearling	Elastomer	Scute Removal

[a]Age of fish when stocked: Fry, Fingerling, Yearling, 1yo, 2yo, 3yo, etc…

Appendix F

Total catch, overall mean catch per unit effort [± 2 SE], and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for Segment 8 of the Missouri River during 2007. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

Appendix F1. Gill Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors below the CPUE value.

Species	Total Catch	Overall CPUE	CHXO		ISB	
			CHNB	POOL	CHNB	POOL
BKBH	1	0.003			0.007	
		0.005			0.014	
BLCF	1	0.003		0.026		
		0.005		0.053		
BUSK*	**446**	**1.193**	**0.225**	**1.263**	**0.709**	**1.919**
		0.297	**0.17**	**0.751**	**0.34**	**0.598**
CARP	7	0.019		0.026	0.02	0.02
		0.014		0.053	0.023	0.023
CNCF	93	0.249	0.075	0.263	0.196	0.345
		0.121	0.109	0.193	0.209	0.215
FHCF	1	0.003			0.007	
		0.005			0.014	
FWDM	6	0.016		0.026	0.014	0.02
		0.013		0.053	0.019	0.023
GDEY	284	0.759	0.15	0.895		
		0.223	0.147	0.6	0.27	0.436
GSCP	1	0.003		0.026		
		0.005		0.053		
GZSD	14	0.037		0.053	0.007	0.074
		0.036		0.072	0.014	0.088
LNGR	74	0.198	0.025	0.053	0.209	0.27
		0.19	0.05	0.105	0.357	0.32
PDFH	2	0.005				0.014
		0.008				0.019
PDSG*	**5**	**0.013**		**0.026**	**0.007**	**0.02**
		0.012		**0.053**	**0.014**	**0.023**
QLBK	4	0.011		0.026		0.02
		0.011		0.053		0.023
RVCS	33	0.088	0.025	0.079	0.054	0.142
		0.052	0.05	0.086	0.056	0.116
SGER*	**51**	**0.136**	**0.025**	**0.132**	**0.041**	**0.264**
		0.049	**0.05**	**0.168**	**0.032**	**0.106**

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB	
			CHNB	POOL	CHNB	POOL
SHRH	42	0.112	0.05	0.158	0.061	0.169
		0.048	0.069	0.172	0.051	0.099
SJHR	1	0.003				0.007
		0.005				0.014
SMBF	13	0.035		0.026	0.02	0.061
		0.02		0.053	0.023	0.043
SNGR	71	0.19		0.026	0.223	0.25
		0.187		0.053	0.368	0.298
SNSG*	**1367**	**3.655**	**2.25**	**4.342**	**2.412**	**5.101**
		0.856	**1.748**	**2.82**	**0.962**	**1.686**
WLYE	7	0.019			0.027	0.02
		0.014			0.026	0.023
WTBS	2	0.005				0.014
		0.008				0.019

Appendix F2. 1 inch trammel net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors below the CPUE value.

Species	Total Catch	Overall CPUE	CHXO CHNB	CONF CHNB	ISB CHNB	SCCL CHNB	TRML CHNB	TRMS CHNB
BHCP	4	0.007			0.009			
		0.007			0.009			
BLCF	1	0.002			0.003			
		0.005			0.006			
BMBF	4	0.007			0.007		0.667	
		0.008			0.008		1.333	
BUSK*	**664**	**1.263**	**0.96**		**1.376**			
		0.208	**0.477**		**0.236**			
CARP	6	0.01			0.013			
		0.008			0.011			
CNCF	192	0.37	0.398		0.369			0.649
		0.091	0.293		0.087			1.299
FHCF	5	0.01			0.013			
		0.009			0.011			
FWDM	7	0.013	0.01		0.015			
		0.012	0.02		0.014			
GDEY	380	0.743	0.946	1.036	0.692			
		0.119	0.379	0.984	0.114			
GSCP	16	0.03	0.009		0.034		0.649	
		0.019	0.018		0.023		1.299	
GZSD	5	0.01	0.021		0.007			
		0.009	0.029		0.008			
LNGR	15	0.03	0.041		0.022		1.299	
		0.018	0.04		0.017		2.597	
PDSG*	**16**	**0.028**	**0.011**		**0.031**	**0.725**		
		0.014	**0.022**		**0.017**			
QLBK	21	0.044	0.063		0.04			
		0.037	0.073		0.043			
RVCS	48	0.093	0.186		0.067		0.667	
		0.032	0.108		0.029		1.333	
SGER*	**31**	**0.054**	**0.049**		**0.057**			
		0.022	**0.044**		**0.026**			
SHRH	8	0.013	0.005		0.016			
		0.01	0.01		0.012			
SJHR	1	0.002			0.003			
		0.004			0.006			
SMBF	19	0.037	0.019		0.043			
		0.017	0.027		0.021			

Appendix F2 (continued).

Species	Total Catch	Overall CPUE	CHXO CHNB	CONF CHNB	ISB CHNB	SCCL CHNB	TRML CHNB	TRMS CHNB
SNPD	1	0.001			0.001			
		0.002			0.003			
SNSG*	**1151**	**2.073**	**0.841**	**2.225**	**2.43**			
		0.639	**0.506**	**4.119**	**0.813**			
STCT	2	0.004			0.005			
		0.006			0.007			
SVCP	1	0.002			0.003			
		0.005			0.006			
WLYE	5	0.01			0.013			
		0.009			0.011			
WTBS	1	0.001			0.001			
		0.002			0.003			

Appendix F4. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors below the CPUE value.

Species	Total Catch	Overall CPUE	CHXO CHNB	CONF CHNB	ISB CHNB	TRML CHNB	TRMS CHNB
BLCF	1	0.004			0.006		
		0.008			0.011		
BMBF	30	0.124	0.015	0.118	0.037	6.667	
		0.174	0.031	0.236	0.039	12.46	
BUSK*	**113**	**0.401**	**0.463**		**0.409**		
		0.097	**0.214**		**0.115**		
CARP	23	0.088	0.18		0.054	0.667	
		0.079	0.334		0.042	0.77	
CNCF	1579	5.678	4.585	0.459	6.265	3.667	2.667
		1.973	2.782	0.525	2.547	4.269	
ERSN	43	0.136	0.04		0.17	0.208	
		0.126	0.056		0.17	0.417	
FHCF	13	0.047	0.099		0.034		
		0.027	0.087		0.026		
FWDM	525	1.985	1.844	0.473	1.627	25.333	9.333
		0.781	1.36	0.515	0.744	29.434	
GDEY	1	0.005	0.021				
		0.009	0.042				
GZSD	4	0.016	0.021	0.118	0.01		
		0.016	0.042	0.236	0.015		
PDSG*	**10**	**0.035**	**0.021**	**0.709**	**0.012**		
		0.03	**0.041**	**0.793**	**0.015**		
RDSN	69	0.239	0.578		0.155		
		0.262	1.13		0.13		
RVCS	22	0.087	0.212		0.038	1	
		0.045	0.15		0.031	1.277	
RVSN	11	0.039	0.065		0.034		
		0.037	0.129		0.033		
SFCB*	**1**	**0.002**			**0.003**		
		0.005			**0.007**		
SFSN	19	0.06	0.008		0.079		
		0.057	0.016		0.078		
SGCB*	**3**	**0.009**			**0.012**		
		0.01			**0.014**		
SGER*	**6**	**0.021**	**0.057**		**0.011**		
		0.017	**0.065**		**0.013**		
SHRH	9	0.024			0.002	1.667	
		0.045			0.004	3.333	
SKCB*	**72**	**0.215**	**0.119**		**0.257**		
		0.1	**0.095**		**0.132**		
SMBF	151	0.54	0.556	0.243	0.415	7.875	
		0.461	0.489	0.322	0.543	15.2	

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	TRML	TRMS
			CHNB	CHNB	CHNB	CHNB	CHNB
SMBS	1	0.004			0.006		
		0.009			0.012		
SNGR	8	0.031	0.059		0.025		
		0.028	0.087		0.028		
SNPD							
SNSG*	**145**	**0.466**	**0.65**	**1.3**	**0.385**	**0.208**	
		0.107	**0.287**	**0.923**	**0.108**	**0.417**	
SNSN*	**29**	**0.11**	**0.186**		**0.095**		
		0.132	**0.201**		**0.17**		
STCT	15	0.049	0.033		0.057		
		0.034	0.046		0.044		
STSN							
SVCB	936	2.993	2.414	0.209	3.343	0.208	
		1.036	1.222	0.28	1.356	0.417	
SVCP							
UCN							
UCY							
WLYE	5	0.02	0.021		0.022		
		0.018	0.042		0.022		
WTBS	27	0.086	0.109		0.084		
		0.057	0.154		0.063		

Appendix F6. Mini-fyke Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors below the CPUE value.

Species	Total Catch	Overall CPUE	CHXO		ISB		TRML	TRMS
			BAR	CHNB	BAR	CHNB	BAR	BAR
BKCP	7	0.058	0.037		0.062	0.167		
		0.049	0.074		0.065	0.333		
BKSS	1	0.008			0.012			
		0.017			0.025			
BLGL	85	0.708	0.926		0.675	0.5		1.5
		0.297	0.584		0.388	1		3
BMBF	600	5	4.222	9	4.9			33.5
		1.972	4.798	18	2.129			25
BSMW*	**1**	**0.008**		**0.333**				
		0.017		**0.667**				
CARP	88	0.733	0.704	1.333	0.688		1	4
		0.409	0.602	2.667	0.551			6
CKCB	9	0.075	0.074		0.038			2
		0.079	0.103		0.056			4
CNCF	312	2.6	2.704	1.333	2.838	0.833	1	0.5
		0.985	1.258	1.764	1.406	1.308	2	1
ERSN	651	5.425	5.037		6.362	0.5		1.5
		2.358	4.259		3.208	1		3
FHCF	1	0.008			0.012			
		0.017			0.025			
FHMW	251	2.092	3.593	4.667	1.688	0.167		2
		0.821	3.041	9.333	0.572	0.333		4
FSDC	2	0.017			0.025			
		0.033			0.05			
FWDM	401	3.342	3.741	3.333	2.9	1.667	5	19
		0.96	1.446	6.667	1.047	3.333		32
GDEY	1	0.008				0.167		
		0.017				0.333		
GNSF	7	0.058	0.074		0.062			
		0.049	0.148		0.054			
GSCP	1	0.008			0.012			
		0.017			0.025			
GZSD	1367	11.392	10.593	2.667	10.925	1.333	1	94.5
		4.937	7.651	2.404	6.287	2.29		35
JYDR	3	0.025	0.037	0.333	0.012			
		0.029	0.074	0.667	0.025			
LMBS	7	0.058	0.148		0.038			
		0.049	0.139		0.056			
LNGR	31	0.258	0.222		0.225			3.5
		0.145	0.195		0.118			7
OSSF	2	0.017			0.025			
		0.023			0.035			

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB		TRML	TRMS	
			BAR	CHNB		BAR	CHNB	BAR	BAR
QLBK	1	0.008	0.037						
		0.017	0.074						
RDSN	4882	40.683	45.333	22		44.562	2.667	0.5	5
		19.549	29.412	21.633		27.495	3.211	1	4
RVCS	30	0.25	0.259			0.212		1.5	1.5
		0.134	0.252			0.154		3	3
RVSN	1221	10.175	21.037	7		7.75	1.667		1
		5.358	21.496	13.013		3.242	2.348		
SFSN	454	3.783	3.63	5.333		4.188	0.833		
		1.225	2.327	10.667		1.608	1.667		
SGER*	**2**	**0.017**				**0.025**			
		0.023				**0.035**			
SHRH	3	0.025	0.074			0.012			
		0.037	0.148			0.025			
SKCB*	**2**	**0.017**				**0.025**			
		0.023				**0.035**			
SMBF	1023	8.525	14.333			5.338	0.333	1.5	102
		4.539	12.364			2.943	0.667	3	162
SMBS	3	0.025				0.038			
		0.029				0.043			
SMMW	1	0.008							0.5
		0.017							1
SNGR	96	0.8	0.407	2		0.3	0.667	24	1.5
		0.593	0.288	4		0.199	1.333	8	3
SNSN*	**406**	**3.383**	**6.296**			**2.938**			**0.5**
		2.257	**7.523**			**2.23**			**1**
STSN	6	0.05	0.148			0.025			
		0.07	0.296			0.035			
SVCB	182	1.517	1.926			1.425	1.833		2.5
		0.511	1.154			0.61	3.283		5
UCN	3	0.025				0.012			
		0.037				0.025			
UCY	1	0.008				0.012			
		0.017				0.025			
WLYE	1	0.008				0.012			
		0.017				0.025			
WTBS	247	2.058	2.296	1.667		1.888		3.5	11
		1.026	1.455	1.764		1.374		3	20
WTCP	8	0.067	0.148			0.038			0.5
		0.046	0.139			0.043			1

Appendix F7. Push trawl: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors below the CPUE value.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB	TRML	
			BAR	CHNB	POOL	BAR	CHNB	POOL	BAR	BAR	CHNB
BKCP	1	0.015		0.117							
		0.029		0.234							
BKSS	7	0.129	0.427	0.348			0.107				
		0.119	0.592	0.697			0.122				
BLCF	22	0.297	0.171	0.046	4.444	0.493	0.046	1.5			
		0.299	0.342	0.093		0.801	0.092	3			
BLGL	1	0.012				0.036					
		0.024				0.072					
BMBF	13	0.222	0.126	0.117		0.154	0.076			3.774	9.259
		0.21	0.252	0.234		0.309	0.114				
BUSK*	**2**	**0.044**		**0.216**			**0.051**				
		0.064		**0.433**			**0.101**				
CARP	10	0.185		0.09		0.501	0.025				
		0.218		0.181		0.648	0.05				
CNCF	101	1.54	0.903	1.102		1.962	1.816				3.704
		0.649	1.106	0.984		1.42	1.198				
ERSN	109	1.501	1.278	0.371		3.581	0.171		1.818	1.887	
		1.238	2.071	0.414		3.591	0.174		3.636		
FHCF	1	0.015	0.126								
		0.029	0.252								
FWDM	90	1.428	1.495	0.335		0.782	0.932	2.5	0.606	22.642	37.037
		0.844	1.645	0.495		0.681	0.519	5	1.212		
GDEY	1	0.008					0.023				
		0.016					0.047				
GZSD	50	0.796		0.155		2.161	0.079		0.741		1.852
		0.846		0.311		2.515	0.116		1.481		
QLBK	2	0.029		0.234							
		0.059		0.468							
RDSN	97	1.616	3.937	0.428		2.827	0.457			1.887	
		0.946	6.473	0.647		1.51	0.649				
RVCS	8	0.175	0.256			0.415	0.023				
		0.157	0.513			0.431	0.047				
RVSN	120	1.857	7.086	0.101		2.891	0.079		1.481		
		1.52	10.614	0.201		2.561	0.116		2.963		

Appendix F7 (continued).

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB	TRML	
			BAR	CHNB	POOL	BAR	CHNB	POOL	BAR	BAR	CHNB
SFCB*	**3**	**0.061**				**0.184**					
		0.088				**0.263**					
SFSN	38	0.735		0.155		2.014	0.074		0.926		
		0.565		0.311		1.631	0.108		1.852		
SGER*	**1**	**0.03**	**0.256**								
		0.06	**0.513**								
SJHR	6	0.083	0.631				0.03				
		0.148	1.261				0.06				
SKCB*	**13**	**0.234**		**0.071**		**0.478**	**0.144**	**0.5**			
		0.203		**0.143**		**0.559**	**0.209**	**1**			
SMBF	92	1.677	2.641			2.139	0.05		1.212	15.094	53.704
		1.357	3.371			2.573	0.07		2.424		
SNGR	1	0.017									1.852
		0.033									
SNSG*	**1**	**0.009**		**0.071**							
		0.018		**0.143**							
SNSN*	**24**	**0.435**	**0.675**			**0.952**	**0.052**		**0.926**		
		0.32	**0.725**			**0.898**	**0.103**		**1.852**		
SVCB	144	2.684	7.721	0.32	4.444	4.472	0.634		0.606		
		1.337	8.197	0.341		2.509	0.494		1.212		
UCY	42	0.699	0.142			0.478	0.311			33.962	12.963
		0.675	0.285			0.475	0.415				
WTBS	19	0.393	0.615			0.894	0.031	0.439			
		0.341	0.691			0.983	0.062	0.877			

Appendix G. Hatchery names, locations, and abbreviations.

Hatchery	State	Abbreviation
Blind Pony State Fish Hatchery	MO	BYP
Neosho National Fish Hatchery	MO	NEO
Gavins Point National Fish Hatchery	SD	GAV
Garrison Dam National Fish Hatchery	ND	GAR
Miles City State Fish Hatchery	MT	MCH
Blue Water State Fish Hatchery	MT	BLU
Bozeman Fish Technology Center	MT	BFT
Fort Peck State Fish Hatchery	MT	FPH

Appendix H. Alphabetic list of Missouri River fishes with total catch-per-unit-effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 20007 for Segment 8 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
BHCP	0.009	0.000	0.000	0.005	0.000	0.000	0.000
BKBH	0.000	0.003	0.000	0.000	0.000	0.000	0.000
BKCP	0.000	0.000	0.000	0.000	0.058	0.000	0.015
BKSS	0.000	0.000	0.000	0.000	0.008	0.000	0.129
BLCF	0.000	0.003	0.000	0.004	0.000	0.008	0.297
BLGL	0.000	0.000	0.000	0.000	0.708	0.000	0.012
BMBF	0.008	0.000	0.000	0.007	5.000	0.240	0.222
BSMW*	**0.000**	**0.000**	**0.000**	**0.000**	**0.008**	**0.000**	**0.000**
BUSK*	**1.484**	**1.193**	**0.456**	**1.050**	**0.000**	**0.350**	**0.044**
CARP	0.016	0.019	0.000	0.003	0.733	0.170	0.185
CKCB	0.000	0.000	0.000	0.000	0.075	0.000	0.000
CNCF	0.370	0.249	3.220	0.370	2.600	7.975	1.540
ERSN	0.000	0.000	0.044	0.000	5.425	0.222	1.501
FHCF	0.015	0.003	0.014	0.004	0.008	0.078	0.015
FHMW	0.000	0.000	0.000	0.000	2.092	0.000	0.000
FSDC	0.000	0.000	0.000	0.000	0.017	0.000	0.000
FWDM	0.017	0.016	0.000	0.010	3.342	3.841	1.428
GDEY	0.845	0.759	0.000	0.645	0.008	0.009	0.008
GNSF	0.000	0.000	0.000	0.000	0.058	0.000	0.000

Appendix H (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
GSCP	0.044	0.003	0.000	0.017	0.008	0.000	0.000
GZSD	0.020	0.037	0.000	0.000	11.392	0.031	0.796
JYDR	0.000	0.000	0.000	0.000	0.025	0.000	0.000
LMBS	0.000	0.000	0.000	0.000	0.058	0.000	0.000
LNGR	0.028	0.198	0.000	0.032	0.258	0.000	0.000
NFSH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OSSF	0.000	0.000	0.000	0.000	0.017	0.000	0.000
PDFH	0.000	0.005	0.000	0.000	0.000	0.000	0.000
PDSG*	**0.021**	**0.013**	**0.003**	**0.034**	**0.000**	**0.064**	**0.000**
QLBK	0.073	0.011	0.000	0.016	0.008	0.000	0.029
RDSN	0.000	0.000	0.275	0.000	40.683	0.205	1.616
RVCS	0.090	0.088	0.044	0.096	0.250	0.128	0.175
RVSN	0.000	0.000	0.038	0.000	10.175	0.040	1.857
SFCB*	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.005**	**0.061**
SFSN	0.000	0.000	0.018	0.000	3.783	0.099	0.735
SGCB*	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.017**	**0.000**
SGER*	**0.043**	**0.136**	**0.025**	**0.066**	**0.017**	**0.017**	**0.030**
SHRH	0.007	0.112	0.050	0.019	0.025	0.000	0.000
SJHR	0.000	0.003	0.000	0.004	0.000	0.000	0.083
SKCB*	**0.000**	**0.000**	**0.278**	**0.000**	**0.017**	**0.156**	**0.234**

Appendix H (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
SMBF	0.054	0.035	0.029	0.020	8.525	1.017	1.677
SMBS	0.000	0.000	0.009	0.000	0.025	0.000	0.000
SMMW	0.000	0.000	0.000	0.000	0.008	0.000	0.000
SNGR	0.007	0.190	0.013	0.037	0.800	0.048	0.017
SNPD	0.002	0.000	0.000	0.000	0.000	0.000	0.000
SNSG*	**2.188**	**3.655**	**0.481**	**1.963**	**0.000**	**0.452**	**0.009**
SNSN*	**0.000**	**0.000**	**0.210**	**0.000**	**3.383**	**0.016**	**0.435**
STCT	0.008	0.000	0.096	0.000	0.000	0.005	0.000
STSN	0.000	0.000	0.000	0.000	0.050	0.000	0.000
SVCB	0.000	0.000	3.016	0.000	1.517	2.971	2.684
SVCP	0.005	0.000	0.000	0.000	0.000	0.000	0.000
UCN	0.000	0.000	0.000	0.000	0.025	0.000	0.000
UCY	0.000	0.000	0.000	0.000	0.008	0.000	0.699
WLYE	0.009	0.019	0.017	0.011	0.008	0.024	0.000
WTBS	0.002	0.005	0.000	0.000	2.058	0.166	0.393
WTCP	0.000	0.000	0.000	0.000	0.067	0.000	0.000

Appendix I. Comprehensive list of bend numbers and locations for Segment 8 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2005-2007.

Bend Number	Bend River Mile	Coordinates*		2005	2006	2007
		Latitude	Longitude			
1	753.0	42.57825	96.68589	FCS		ST, FCS
2	750.1	42.56583	96.65742	ST	ST, FCS	
3	747.0	42.53202	96.63314	ST		
4	742.4	42.51325	96.57624			
5	738.4	42.49678	96.51796	ST		
6	734.7	42.48684	96.45852	FCS		ST, FCS
7	732.8	42.48807	96.42054			
8	732.0	42.48738	96.40472	ST, FCS		
9	726.2	42.42051	96.40273		ST, FCS	ST, FCS
10	723.4	42.39183	96.40943	ST		
11	722.0	42.36302	96.41621	ST, FCS	ST, FCS	ST
12	718.6	42.32747	96.39770			ST
13	716.2	42.29593	96.36894	ST	ST, FCS	
14	713.8	42.27124	96.34558			
15	710.8	42.22921	96.34905	ST		ST, FCS
16	708.0	42.20139	96.35211	ST	ST, FCS	
17	706.3	42.15237	96.32699			
18	704.0	42.15238	96.32696	FCS	ST, FCS	ST
19	702.6	42.13729	96.31451	ST		
20	700.9	42.12567	96.28559	FCS	ST, FCS	
21	697.5	42.08348	96.27596			
22	693.6	42.03692	96.25323	FCS		ST, FCS
23	691.4	42.01067	96.25070			
24	689.0	41.99635	96.21485			
25	687.4	41.98440	96.18535		ST, FCS	
26	686.0	41.97991	96.16115	ST, FCS		ST, FCS
27	683.3	41.95320	96.14312	ST		ST, FCS
28	681.2	41.92972	96.13779	FCS	ST, FCS	
29	679.9	41.91335	96.15257			
30	677.9	41.89110	96.15073	FCS		
31	676.7	41.87720	96.14666	FCS	ST, FCS	
32	675.0	41.85706	96.11990	ST, FCS	ST, FCS	
33	672.8	41.83184	96.11089			
34	670.4	41.81055	96.08199	FCS		
35	666.5	41.76998	96.08234	ST		
36	663.1	41.72374	96.09276	ST, FCS		
37	660.8	41.69683	96.11442			
38	657.8	41.66176	96.10053			ST, FCS

* Coordinates represent the upper most point of the bend (i.e., the top of the bend going upstream).

Appendix I (continued).

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2005	2006	2007
39	654.8	41.62627	96.11212	ST, FCS		
40	651.7	41.58979	96.09441	ST	ST, FCS	
41	649.1	41.56472	96.08817	FCS		
42	644.5	41.51604	96.04839	ST		ST
43	642.0	41.48704	96.01946			
44	639.8	41.47162	95.99432		ST, FCS	
45	638.5	41.46579	95.97250	FCS		ST, FCS
46	637.1	41.46557	95.94932	FCS	ST, FCS	ST, FCS
47	634.1	41.43762	95.92690			
48	632.5	41.41723	95.92982	ST, FCS	ST, FCS	ST, FCS
49	631.1	41.39907	95.93616	ST, FCS		
50	629.7	41.37711	95.93014	FCS	ST, FCS	
51	627.8	41.35655	95.94707	FCS		
52	622.8	41.32133	95.90372			
53	617.5	41.27415	95.90434	ST		
54	614.6	41.24317	95.91311			ST, FCS
55	612.8	41.21684	95.92189			ST, FCS
56	608.8	41.18710	95.88354			
57	604.5	41.16652	95.85924	FCS	ST, FCS	ST, FCS
58	600.8	41.12857	95.87099			
59	599.3	41.10926	95.86701			
60	598.0	41.09439	95.86311			
61	596.0	41.06979	95.87816			ST, FCS

* Coordinates represent the upper most point of the bend (i.e., the top of the bend going upstream).